SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; JOSEPH LE CONTE, Geology; W. M. DAVIS, Physiography; HENRY F. OSBORN, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoology; S. H. SCUDDER, Entomology; C. E. BESSEY, N. L. BRITTON, Botany; C. S. MINOT, Embryology, Histology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; WILLIAM H. WELCH, Pathology; J. MCKEEN CATTELL, Psychology; J. W. POWELL, Anthropology.

FRIDAY, MAY 10, 1901.

CONTENTS:

The Dignity of Chemistry: DR. H. W. WILEY... 721

Diamond-Glass Fluorescence: DR. ARTHUR L. FOLEY 732

How Botany is Studied and Taught in Japan: KRICHI MIYAKÉ 734

Scientific Books:—
Schuyler on Reservoirs for Irrigation, Water Power and Domestic Water Supply: PROFESSOR I. P. CHURCH. *Annual Report of the War Department:* PROFESSOR R. H. THURSTON. *Titchener's Experimental Psychology:* PROFESSOR JOSEPH JASTROW. *Pierce on Peach Leaf Curl. Books Received.* 738

Societies and Academies:—
American Mathematical Society: DR. EDWARD KASNER. *Zoological Journal Club of the University of Michigan:* PROFESSOR H. S. JENNINGS 744

Discussion and Correspondence:—
Correction to André's Astronomie stellaire: PROFESSOR GEORGE C. COMSTOCK. *An Appeal for Cooperation in Magnetic and Allied Observations during the Total Solar Eclipse of May 17–18, 1901:* DR. L. A. BAUER. *Clayton's Eclipse Cyclone and the Diurnal Cyclones:* H. HELM CLAYTON. *Leland Stanford Junior University:* PROFESSOR J. C. BRANNER and others..... 746

Current Notes on Physiography:—
Topographic Atlas of the United States; Terraces fronting the Rocky Mountains; The Formation of Deserts: PROFESSOR W. M. DAVIS..... 751

The American Geographical Society..... 753

Resolution of the Committee of Central Naturalists... 753

Scientific Positions under the Government 754

Scientific Notes and News..... 755

University and Educational News 760

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

*THE DIGNITY OF CHEMISTRY.**

CHEMISTRY as a profession may be said to have completed its hundredth year, and we have met to-night to celebrate the quarto-centennial of chemical organization in America.

In our democratic country, all attempts to create a class or caste should be discouraged, especially if the attempt be made to endow the class with unusual or special privileges. We have no place for an hereditary or purchasable aristocracy, but in the function of the civic body there must be specialization, and those individuals who by choice or fortuitous incident devote themselves to special duties are brought together by occupation, by congeniality and by desire for mutual helpfulness and improvement. In this mutual attraction we find the genesis of all trade and professional organization. The aggregate is always stronger than the segregate. This unity of purpose and this conformity of effort become reprehensible only when autocratic, imperative and insolent. The assumption of superior virtues, the assertion of peculiar privileges and the interference with the rights of others are never to be advocated nor condoned.

* An address delivered before the American Chemical Society, April 12, 1901, on the occasion of the celebration of the 25th anniversary of the founding of the Society.

Every honest effort to earn a living and a competency is worthy of equal praise, and therefore in dignity of effort there is no rank. The workman in the woods, the farmer in the fields, the artisan in the atelier and the mechanic in the mill have an equal claim to the dignity of labor with the preacher, the lawyer and the professor. There is no form of labor which is beneath the dignity of any man. Instead of being a curse, labor is the greatest blessing which Providence, fate or evolution has conferred on humanity. Tolstoy, one of the greatest of living novelists, earns his living from the soil. Peter the Great was a carpenter and is said to have done much of the work in building the old palace at Peterhof. Louis XVI. was a locksmith. Washington was a farmer, Lincoln a rail-splitter, Grant a tanner, Garfield a canal boy. The natural and normal desire of men who have achieved greatness is for a piece of land where they can be in touch with the great mother of us all, the soil. To him who appreciates the true dignity of labor, no task is menial. The hands are made for toil as much as for fighting, and sweat is the most efficacious of all detergents. In derision on one occasion the Romans made Cato commissioner of sewers, but he discharged the duties of his menial office with such industry and benefit to the city that thereafter to be made commissioner of sewers was considered to be a distinguished honor.

So the true philosophy should teach us that our calling in life is a *cloacum magnum* which we are to administer, not with closed nostrils, but with open eyes and hands that do not recoil before thickened cuticle and stains.

He who is not proud of his profession is not worthy of it. This does not mean that his profession is any better than another, but when the heart is not in the work the head is sluggish and the hands are slow. Nor do I mean that a profession should not be regarded as a means of making a living. On the contrary, that is the first and chief end of any occupation. The number of persons who work alone for the love of it is exceedingly small. Perhaps there is only one profession where it is better that a man be rich, and that is the profession of politics. Making a living out of a public position is the most precarious of all professions, and there is no collection of dependent fossils which appeals so pathetically to general commiseration as that vast aggregation of exes which lingers near the cupola of the Capitol. The *functus officio* faster has fed so long at the public crib that he knows not the taste of other food nor the means of getting it. The last of his life is an eternal Lent on which no Easter morn of soothing satiety will ever rise.

In one short walk a few days ago, I met one ex-senator and two ex-representatives, who a few years ago were farming patronage and feasting on lobster Newburgh at Chamberlins, who are now seeking to be attorneys for the holders of claims that live only in the hope that a far-off indulgent future will no longer know their worthlessness. Hungry are the looks of these men, with jaws cavernous as those of Cassius, and sad warnings of the fate of a statesman out of a job. A profession, therefore, should offer some guaranty of a livelihood dependent on merit and industry, and not upon the whim of a capricious public.

It is not my purpose to-night to discuss chemistry as a living-provider. Often young men come to me and ask my advice in regard to choosing a profession. They come often with a strong inclination to chemistry and want to know what I think of the prospects for success. If they have already studied chemistry, I invariably ask: Have you a taste for chemistry? Do you love chemical studies? If they do not know, or if the answers are indefinite or

evasive, my advice is always, 'Stay out.' But especially is this so if they propose to study chemistry as a profession because it is an easy road to wealth. Alas! the paths of chemistry seldom lead to 'easy street.' True it is, you rarely see the chemist begging bread. Perhaps he knows too well of what it is composed. The chemist tramp too, is a kind of a *rara avis in terris cygno simillima nigra*. The chemist may be able to change phosphorus into arsenic by oxidizing it in presence of ammonia, but even so distinguished a man as Carey Lea could only make silver yellow, and further than this scientific transmutations have not extended. Fortunes have been made by a few. A happy discovery in metallurgy or in manufacturing processes has often brought a modest fortune to the inventor, but most of the roads leading from the Patent Office end in the cemetery of hopes at first vigorous from the pliant pabulum labeled 'Having now described my invention what I claim is,' etc., 'substantially as set forth.' The parchments with the flaming seals that protect you in the sole usufruct of your genius for a period of 17 years serve most frequently as fitting cerements for the deceased. If the chemist be a teacher or employed at a salary the prospect for a competence is not much better. At best these stipends are not very large. In a manufacturing enterprise, the chemist often becomes the manager, and in this case he can put by something for 'a rainy day.' If a professor, he sometimes gets to be the president of the college, provided his theology is untainted. But Universities of Chicago are not found in every academic grove. Most of our institutes of higher learning are chronically impecunious, and even the professional chair is not upholstered with a cushion which would tempt the expectant Croesus.

In general, then, it must be admitted that whatever of dignity is due the profession of chemistry is not attributable to its tendency to wealth.

I am not of that school which despises wealth, nor yet of the cult that loves it. Poverty, doubtless, has its uses in evolution and molding of character. Wealth often corrupts youth and makes of manhood but a purveyor of vice. But poverty also invites crime, and is not the most efficient preservative of virtue. A modest competence, possibly, is the ideal state, best suited to highest development and greatest usefulness. It is not always dignified to be in debt. For this reason, I should like to see the influence of this great organization whose foundation we celebrate to-night, exerted to secure better pay and more permanent employment for its members. I know this seems sordid and mercenary, but we must not always live in the clouds. The cerulean atmosphere will be more gratefully stimulating and its views be more thoroughly appreciated if we manage somehow to keep our feet well braced on terra firma. To him who cannot swim, things begin to feel a little queer when the advancing tide leaves him touching only a little flowing sand with the tips of his toes. Good and steady pay, therefore, to its devotees is no small contribution to the dignity of chemistry.

The pursuit of science is nothing else than an effort to know something of the constitution of the natural world. That knowledge is not derived from an ingenious system of vain imaginings, but is secured by a study of nature herself.

"To him who in the love of nature holds communion with her visible forms she speaks a various language," sang one of our great poets at the age of 17. Had he lived until he was 100 and grown in wisdom every year he could not have touched a truer note. The language which nature speaks to the chemist is a description of the ultimate nature of things. It is to the

chemist that nature teaches the alphabet of human knowledge. In this sense the chemist comes nearer than any other to first principles. As we grow in knowledge, we sometimes forget our small beginnings. And so it sometimes seems to me that our professional brethren of other schools are prone to despise the day of little things. Atoms and molecules are too small to cut much of a figure in the economy of nature, think some. But it is no true mark of greatness for the macrocosm to forget the microcosm. A megatherium is not the 'whole show.' It is true that in some respects chemical achievements appeal least of all scientific accomplishments to the popular attention. The isolation of krypton does not have half the interest for the public that attaches to the discovery of a new bug, especially if it have domestic tastes. In fact all the biological sciences, with the possible exception of physics, find a readier and more appreciative public than those which deal with things lifeless and for the most part incomprehensible to the layman. This truth is uttered in no complaining mood, but only to explain why Davy is not as well known as Darwin, nor Hoffmann as Haeckel. It is when chemical studies and discoveries come directly into contact with life that they lead to recognition, as in the case of Pasteur, whose great genius is recognized the world over, perhaps more generally than that of any other scientific man has ever been. But it is not alone for public applause that life is worth living, and the dignity of our science suffers no depreciation because of its apparent remoteness from human interest. I say apparent, because I do not believe that any other science has in reality any nearer bearing on human welfare than chemistry. Think for a moment how many of our industries that lie at the foundation of wealth and progress are based directly on chemistry. Think of the many others that are intimately related to it indirectly. If the clock of political progress and liberty were turned back 50 years by the battle of Waterloo, think of the loss to humanity should such a disaster befall the hosts of chemistry. Bourbonism is the natural foe of human progress, and unhappily the world is still full of anti-scientific Bourbons.

Whatever may be the branch of the profession which the chemist may pursue, he should not be indifferent to feelings of justifiable pride which come to him when he realizes all that our science has done for humanity. The disciples of evolution may have attached some opprobrium to the epithet, but the chemist is the 'connecting link' between the world of matter and mankind. We stand the nearest of all our brethren to the ultimate constitution of things, so near, in fact, that we almost tremble at the thought that by some subtile synthesis we may yet strike the spark of organic life. Of one thing at least we may feel sure. We know best of all our brethren the environment of development and growth. We may never create an environment which will make autogenesis possible, but we surely can soften some of the harder conditions of existence. To be so near the first forms of life, to be so nearly in touch with the ultimate secrets of nature, are facts which show some of the principal elements of the dignity of chemistry.

No man can lay claim to the term scientific who does not reverence the truth. That is the first element of a scientific mind. The truest proof of a reverence for the truth is a willingness to be convinced. In the times of Cromwell, the truth was supposed to be simply the dogmas of the creed, which led Hudibras to say :

> "Convince a man against his will,
> He'll hold the same opinion still,
> And prove his doctrine orthodox
> By apostolic blows and knocks."

The most difficult mental attitude, which the scientific man has to contend with in his struggle for the truth, is bias. We inherit, in a measure, certain notions of things and of life. This natural inheritance is strengthened by the earlier teachings of childhood, so when we reach the age of maturity we have formed certain opinions, we are endowed with certain habits of thought which tend to dominate our mental attitude. Happily, most of these habits and most of these inheritances are sound, but now and then we find one which is clearly opposed to the conditions of existence as science reveals them. How difficult in this case to let go the old notion; how hard to bring one's self into an attitude to receive the truth! Perhaps it is only a species of conservatism which leads man to hold on to that which he has, and in this sense a certain difficulty of conviction is a guaranty of stability of thought and of social, economic and political conditions. In other words, we should heed the warning in the Bible and not be swayed by every 'wind of doctrine.' The tendency to too eagerly accept is more reprehensible than tardiness of belief. We have all seen wave after wave of illogical belief sweep over the country, and no difference how absurd a theory may be or how impossible a course of action which is marked out, it finds plenty of adherents. This instability tends to render all the conditions of natural growth and development precarious. The scientific man must be on his guard against being buncoed by any plausible or specious doctrine, as well as to keep his mind open for the acceptance of the truth. Here is where judgment comes into play, and not only should the scientific mind be open to conviction, but it should also be controlled by a sober and discreet judgment which can discriminate between the true and the false in evidence. But when soberly considered, certain facts are brought home with an overwhelming evidence of truthfulness, the results of this evidence should be accepted, no matter how contrary they may be to our preconceived notions. Perhaps the greatest offense in this direction which the scientific man commits is a distortion of evidence to suit the case. By a slight inclination this way or that from the true point of direction an observed fact may be made to support this or that theory or condition. I am far from belittling the value of theory. When formed on substantial evidence and with a becoming ingenuity it is a valuable aid in the discovery of further truth, but a theory should never be a fetich to be reverenced and worshipped with the blind devotion of the religious devotee. There is nothing sacred about the theory. It is only a valuable tool to be cast aside when a better or more effective one is at hand. The dignity of our profession, therefore, has been strengthened and increased by the habit of the chemical mind of accepting the dicta which experimental evidence has provided. Detracting somewhat, however, from this dignity has been the fact that certain contentions have arisen in our profession over the interpretation of ascertained phenomena. Chemists may agree upon the character of certain phenomena which are presented, but construe them differently, and often with acrimony. A scientific discussion should be conducted with all the dignity of a scientific dissertation, and the honest differences between chemists should never be allowed to degenerate into personalities or innuendo. There is no excuse whatever for speaking slightingly of the honesty or ability of a brother chemist who may happen to differ from you in his opinion of phenomena. Envy, backbiting, slander and scandal have no place in the chemical profession. I believe every one will admit that there has been less of it in the profession of chemistry than in almost any other. We know to what extent the per-

sonal quarrels among many scientific men have been carried in this country, and we are glad to say that there is no instance in which these quarrels between chemists have come into our organization to influence our action and mold our policies or to cause the growth of faction and the promotion of feuds.

There is enough for every one to do in this country without wasting his energies with envy of the accomplishment of others. About the most unprofitable occupation into which a man can fall is to complain of a lack of appreciation. It is doubtless true that in many cases the worthy man is cheated of his dues and the unworthy receives a reward out of all proportion to his services. These are accidents, which are due to the imperfection of human nature, and not to any peculiarity of scientific pursuits. There should be room for the philosophy of life in chemical science as in every other. The sensible way is to accept what happens, and not to degenerate into a kicker or the carrier of a club. The chips which are found on the shoulders of our associates are usually magnifications of the motes in our own eyes, and not due to the deposition of any really ligneous material upon the clavicle of our supposed enemy. We have plenty to do in this world without going about knocking off hypothetical chips. I have the profoundest sympathy for the man with a just grievance, and I know how many have them, but there is no greater nuisance than this same man with this same just grievance. The man who shuts his mouth, compresses his lips and bears the pain and humiliation without a sign is the one who wins our admiration in the end and often turns disaster into good.

With a proper appreciation of the dignity of our profession, we will therefore do our work as well as we can and be glad of the greater success of our professional brethren, and not find in it a cause of sorrow and dejection. Every man who succeeds in chemistry does a work to elevate our profession and to help us all, and therefore, even from a selfish motive, we should be glad of his achievements. I realize how hard it is to see others preferred when we feel convinced that we should have had it, and yet I must be allowed to praise the courage of the man who with a smile on his face and a true feeling of well-wishing in his heart can congratulate the more successful man not with hypocritical words, but with a real sentiment of satisfaction.

There is one special way in which I think our great organization can do much to elevate the dignity of chemical science. I have spoken of the fact that chemistry does not appeal directly to the public imagination, and for this reason many of our best people do not have a true appreciation of the value of chemical services. An honorable and praiseworthy part of our profession is the rendering of professional services of a chemico-technical nature to the great industries of the world. Too often the promoters of these industries, the men with the money, the men on the boards of directors, and the stockholders, do not appreciate the real value of the services they ask for. A great corporation is perfectly willing to pay a great lawyer $10,000, $15,000 or even $50,000 for professional services, whereas if a chemical expert should ask $1,000, it would produce a kind of corporative hysteria or nervous prostration, while, in point of fact, the technical services demanded would probably be of far greater financial utility than the legal services so much more liberally paid for.

There has been a tendency among some of our profession to foster this spirit of contempt for the value of chemical services of a professional nature, not intentionally, I am glad to say, but because of a feeling, which I can hardly describe, that it is not

dignified for a chemist to sell his services for money. The falseness of this position, it seems to me, has been fully set forth in the earlier part of this address, and I believe that every right-minded person will admit that it is not derogatory to dignity to receive pay. Otherwise, I should think that we should cast dignity to the winds and look out for the 'main chance.' In my opinion, it is just as honorable and worthy to give professional advice to a great industry as it is to discover an unknown element. In our society we should have far more *esprit de corps*, more regard for the rights and privileges of each other, and a better understanding of the ethics of our profession. It is true that we now act upon the principle that it is dishonorable to take an investigation out of the hands of a brother who has once commenced it, without his permission, or in any way to trespass upon the fields which he has preempted. In like manner we have learned that it is dishonorable to underbid a professional brother in offering our professional services. It seems to me that the Society can do a great good towards promoting the dignity of our profession in this way by establishing not a hard and fast schedule of prices for professional services, but by bringing closer together our members who give these services so they may have a better understanding of the rights and privileges of each other. Other professions do this, especially the medical, and great benefit would be derived from a better understanding in regard to these matters.

Especially is this true from the effect it would have upon the public at large who, seeing a profession stand together and in a dignified manner demand what is right and just, would better appreciate the value of the services which they often hope to get for the very smallest possible consideration.

Perhaps the bitterest criticism to which the chemist has been subjected has grown out of his services as expert before the courts. Here we often have the spectacle of two men, under oath, one in affirmation, one in negation. It is only natural that the expert should favor his client, but that favor should never go so far as to impugn the truth. When there is room for disagreement, I can see no impropriety in the chemist supporting with all his ability the side that employs him. He is not hired to discuss the whole problem in all its aspects, but to develop those points which make for the benefit of his employer. We cast no reflection on the honesty of the lawyer who defends, nor should we on the rectitude of the witness who testifies. But no worthy chemist will deliberately undertake to support a falsehood. Whatever of viciousness may attach to expert evidence is the fault of the system rather than of the witness. We all admit that it would be far better for the court to employ the expert, and not the plaintiff or defendant. But until that change has been made, the chemist is undoubtedly right in making out the best case possible for his client, provided he distorts no facts.

How far he can go with patent medicines, nostrums and secret preparations is another story. The dignity of our profession forbids any taint of humbug or quackery. This field, therefore, seems to be absolutely closed for professional purposes.

I would not have our Society become a trades union, and especially would I be sorry to see it exercise the tyranny which such unions often manifest, but I would like to see a better understanding established in matters of this kind, both for the sake of our members and for the benefit of the public at large.

The dignity of the profession of chemistry is illustrated in a striking way by the active participation which it exercises in many of the greater walks of life. I have not time

here to go into statistics and show the relative number of chemists employed in the industries as compared with members of other scientific professions. We will admit without such an array of figures that there is no other scientific profession, with the possible exception of physics, which begins to be so numerously represented in the great industries as the science of chemistry, and even in the case of physics, aside from the electrical industries and those of a purely engineering character, the physicists engaged in the active industries are not numerous.

When it comes to mining engineering, we find that the engineer himself must be a chemist in order to be fully able to discharge the duties of his profession. In so far as statistics are concerned, I will content myself with a few citations showing the preponderance of chemical employees in the great scientific agricultural industries of our country.

In a study of the impress which chemical research has made upon agriculture, there has been no factor during the past twenty years which can compare with the work of the agricultural experiment stations of the United States. Richly endowed as they are by the General Government, they have had every opportunity to secure the best results for practical agriculture.

In this work chemical science has played a very important part in the furthering of agricultural prosperity. Of the forty-nine directors of the stations at the present time twenty were professional chemists at the time of their appointment. The selection of so many professional chemists was no mere chance, but evidently had some relation to the dominant position which the science of chemistry holds to the promotion of agricultural chemical research. The list of directors of the agricultural experiment stations of Germany shows the same condition of affairs.

The great influence of chemistry on the agricultural experiment stations of this country is not measured alone by the number of professional chemists which is found in the directorates, but also by a comparison of this number with that of other scientific men holding similar positions. Very few of the other sciences are represented among the directors of stations, and no one of them can compare in its number of representatives to the science of chemistry. Among the working forces of the stations chemists also predominate. There are twice as many chemists employed in the stations as there are men engaged in any other professional scientific work. Statistics show that the number of chemists employed in the agricultural experiment stations of the United States is one hundred and fifty-seven, while the number of botanists is fifty and the number of entomologists forty-two. The number of employees belonging to other branches of science is very much less than that of the botanists and entomologists, and the total number of scientific men employed in all other branches of scientific work in the station does not greatly exceed, even if it be equal to, the number of those employed in chemical research alone.

While dwelling upon the predominance of professional chemists in the directorates and upon the staffs of the experiment stations, it seems eminently proper to mention here in a special manner some of the earlier eminent chemists who have contributed so much to the value of chemical research in our agricultural colleges and experiment stations. Among these must be mentioned Professor F. H. Storer, of the Bussey Institute (Massachusetts), who first began the regular publication of a bulletin recording the work of the school and station, which has 'set the step to which the bulletins from many other stations are still marching.' The bulletins of the Bussey Institute describing original research work on agricul-

tural subjects have proved of the highest benefit to agriculture. Professor Storer's work, entitled 'Chemistry in some of its Relations to Agriculture,' the first edition of which was published in 1887, has had a marked effect upon agriculture in this country.

As early as 1846 Yale University, then called Yale College, appointed a professor of agricultural chemistry. This was John Pitkin Norton, who had devoted himself to the study of scientific agriculture both in this country and in Europe, especially with the celebrated Liebig. He brought to his position a ripe knowledge and wisely directed enthusiasm for agriculture, which he used with the greatest profit in its service. In 1855 Samuel William Johnson was appointed instructor in agricultural and analytical chemistry, and soon after full professor. Perhaps no one ever succeeded more fully in popularizing scientific agriculture than Professor Johnson. His two books, 'How Plants Feed' and 'How Plants Grow,' the first editions of which were published in 1868 and 1870, respectively, have been kept abreast of modern progress in successive editions, and are still used as standard text-books and as authorities on the practical relation of chemistry to agriculture.

In the University of California, the work of Professor E. W. Hilgard must be mentioned as being of fundamental importance in the development of the relation of chemistry to agriculture in this country. Professor Hilgard, in his classical work on soils, has placed himself in the front rank of investigators on this subject, not only in this country, but in the world, and his achievements have been recognized both by his countrymen and by the most celebrated societies of Europe. A knowledge of the soil and its relation to plant growth constitutes one of the fundamental principles of agriculture chemistry, and the researches of Professor Hilgard in this line have done much to place agriculture in the United States on a strictly scientific basis.

At Cornell, even before her doors were open to students, a professorship in agricultural chemistry was established. Professor G. C. Caldwell was appointed to fill this position, and he has done so with distinction to himself and to the University and with the greatest benefit to agriculture. One of the most important services in connection with Professor Caldwell's labors at Cornell was the publication of his work on agricultural chemical analysis in 1869. At that time no work of a similar nature existed in the English language, and Professor Caldwell's book was a veritable boon to students in agricultural science.

This brief reference to the contributions of some of the earlier workers in agricultural chemical science in this country would not be complete without mention of the labors of Professor C. A. Goessmann, of the Massachusetts Agricultural College.

It is not possible in the space assigned to this address to even name the more prominent later workers.

A national epoch in agricultural education in this country began with the passage of the Morrill Act, in 1862, establishing and endowing colleges where agriculture should be one of the principal branches in which instruction is given. An additional impetus was given to this great work in 1887 by the passage of the Hatch Act, establishing agricultural experiment stations in the several States. The organization list of the agricultural colleges of the United States now shows the great number of men working in lines of agricultural chemistry. This most remarkable evolution of agricultural education has taken place practically within the last thirty years, and there is no country which can now be compared with the United States in the munificence of the endowment for agri-

cultural chemical research or in the vast amount of research and experimental work conducted in these lines.

Another way in which our profession has influenced higher education in this country is found in the large number of chemists who have been called to preside over our higher institutions of learning. Of the leading institutions in this country, Harvard University, Lehigh University, the University of North Carolina, the University of Tennessee and Purdue University are presided over by professional chemists, or rather, I should say, by those who before elevation to the presidential rank were professional chemists. I doubt if any other branch of science can show so many college and university presidents as our own. It is certainly not a mere accident that in the breaking away from the old scholastic habit of placing ministers of the gospel over institutions of learning, chemistry has received so marked a favor. In fact, the pursuits of chemical science, it seems to me, tend more than other scientific occupations to broaden the mind and to bring it in contact with all the varied industries and forces of active life. It is true that other branches of science have their economic aspects, and we do not by any means desire to minimize that important relation, but they do not come so generally into contact with human affairs. While they appeal in the nature of their services more to the public imagination, when it comes to real practice they do not have that influence which our own science possesses.

I am far from saying that the pursuit of chemical studies tends, in any peculiar way, to develop administrative ability, and hence it cannot be in this collateral way that so many of our brethren have reached these higher places of administrative effort.

While we do not claim that chemical science holds in any way the same dominant position in didactics that it does in agriculture, we do find, even in the smaller institutions of higher learning, that, as a rule, chemical science is taught more thoroughly and more effectively than other branches. The consideration of these facts, if prominently brought before the attention of the public, would certainly do much to increase the estimation in which our profession is held.

The above only illustrates in one industry the dominant influence of chemical research, and in so far as science comes into direct contact with the industries of the world it is evident that in almost every one chemistry occupies the predominant position. This well-recognized fact is a firm basis for the substantial claims of the dignity of our profession.

There is one point, however, in which it seems to me we are much at fault, and that is in the fact that the chemists of this country seem to have taken but little interest in the science of civics. We are too prone to regard politics as a profession beneath the dignity of a scientific man, and yet we must admit that the organization of the body politic for the public good is the highest work to which a man can devote himself. In other words, real politics is the most useful and most honorable of professions. The trouble here in this country is that politics becomes too much of a profession. In other words, it becomes a source of revenue or of sole revenue. How much better it would be if men who have reached success and competence in other professions, without abandoning these in their maturer years, would devote a portion of their time to the public good. In Europe this is commonly the case and we are all familiar with the names of eminent scientific men who have become celebrated also as leaders in political life. In Germany, we recall the name of Virchow, who, for more than thirty years, has been a member

of the National Legislature, and of Mommsen, the great historian, who has taken an active part in politics. In Italy, one of the honorary members of our society, Cannizaro, is a senator and vice-president of that body. In France Berthelot is a life senator and has been minister of foreign affairs. In England, Roscoe has been a member of Parliament and Faraday and Humphry Davy and other scientific men were active in public affairs. In our country, I believe, only one member of the Chemical Society has ever become a member of the National Legislature and this was due to a fortuitous combination of most incompatible elements, namely, a union of democracy and prohibition.

I think we should all strive to discourage this sentiment, which is so prevalent, that politics is a dirty pool and that men of science should keep out of it. When you have reached competence and distinction in your profession what better service to which to apply your leisure hours than the study of the public weal? There are so many ways in which science can be utilized in political and civic affairs. The conservation of the public health, the prevention of epidemics and contagious diseases, the control of the water supply of cities, the disposal of the refuse of cities, the study of dangerous and fraudulent counterfeits of foods, are all matters affecting directly the public health and the public welfare. To become interested in these matters would be to more actively participate in public affairs, and it seems to me it is an ambition which every scientific man might well entertain, not only to become eminent in his profession, but also to devote a portion of his more mature life to the study of the public welfare and the active participation in those political relations of life which will enable him to become more useful to humanity.

May we not then expect to see the day when our State and National Legislatures shall not be considered as properly organized until they have among them members representative of the great body of American chemists?

On April 12, 1976, will be celebrated the centenary of our society and shortly thereafter the bicentennial of our national independence. May I drop for a moment the rôle of chemist and assume that of prophet? Our country will have then about 225,000,000 inhabitants. Our foreign export trade will amount to more than $500,000,000 annually. The revenues and expenditures of our Government will each reach the annual sum of $4,000,000,000.

The average yield of wheat in the United States will be nearly 25 bushels per acre, and the average yield of other field crops be proportionately greater than now.

Diversified manfacturing industries will flourish in every part of the country, thus distributing population and encouraging agriculture. The product of a day's labor will be double that of to-day, thanks to new processes, improved machinery and greater skill. The condition of the artisan and the laborer will be greatly ameliorated, and the principles of the trust, which now help chiefly the capitalist, will be extended to include the working man as well. The laborer will not only have a larger daily wage, but will also share in the legitimate profits of the business.

The advancement of chemical science will not only make the fields more productive and more easily tilled, but will also teach how their products can be more economically and easily consumed. Good roads will lead everywhere and the horse be relegated to the museum and the stable of the sportsman. New sources of energy will take the place of coal and gas, and this energy will come from the winds and the rains. The sun directly and indirectly will monopolize the power of the country, working

through evaporation and precipitation and by means of electricity or some more useful force.

By a general comprehension of the principles of nutrition, food will be more wholesome and more potent. The general acceptance of the principles of hygiene will make the average life of man longer and his usefulness more fruitful. Man will not only live longer, but he will be happier and practically free from the threats of enzymic, contagious and epidemic diseases. When this Society meets on that founders' day, the membership will be nearly 10,000 and its organization will reach to all quarters of our imperial country. The number of those who to-day are members and who shall live to 1976 is not large, possibly *nil*, but many who are infants to-day will be the revered old men on that centennial occasion. The orator who will address you on that day is perhaps not yet born. I hope he will take for his theme, the 'relation of chemical work to the advancement of mankind in the past century.' He will find in the development of some of the thoughts which I have tried to bring to your attention to-night the most potent causes that make for the good of man. In such a light as he can shed on life and its conditions the coming man will be able to see the true dignity of chemistry. H. W. Wiley.

U. S. Department of Agriculture.

DIAMOND-GLASS FLUORESCENCE.

Some five years ago I had occasion to cut a large number of photographic dry plates to smaller sizes. They were cut in the usual way—with a diamond and on the side of the plate opposite the film. In developing it was noticed that the film, to a breadth of a few millimeters along the edge of the plate, turned dark as if exposed to light.

Several possible explanations suggested themselves.

1. The breaking of the glass might produce momentary fluorescence and a fogging of the film near the break.

2. The breaking or tearing of the film might result in some sort of change in its character.

3. The scratching of the diamond might set up mechanical disturbances or vibrations in the glass and these might affect the film.

4. The friction between the diamond and the glass might cause a momentary fluorescence along the line traced by the diamond, and the radiation might penetrate the glass and fog the film on the other side.

The first and second suggested explanations were thrown aside at once, for the dark band in the film was found along the diamond scratch, whether the plate was broken or not.

That the third is not the true explanation was shown in several ways. The breadth and density of the dark band did not appear to depend upon the depth of the cut or the rapidity with which it was made. The line was always of about the same breadth on the same plate, but of different breadths on different plates. Moreover, the film always developed first on the side next the glass. The effect was noticeable on the most sensitive plates only.

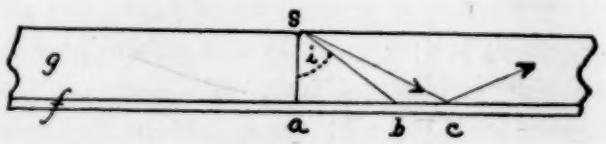


fig 1.

Let f represent the film on a section of the glass plate g, perpendicular to the diamond scratch s. Let s be a source of radiation.

All rays (as sc) outside the critical angle i are totally reflected and hence do not affect the film. Those having an incident angle smaller than i penetrate the film and

fog it, if they are of sufficient intensity. The breadth of the fogged line is

$$b = 2\overline{a\ b} = 2\ t.\ \tan\ i$$

where t is the thickness of the glass plate and i is the critical angle for glass and the film substance. Using plates of different thicknesses, it was found that, in every instance, b varied as t to the degree of accuracy with which the measurements could be made. When a clear glass plate was laid on the dry plate, scratching the upper plate gave a band whose width varied as the combined thickness of both plates. If, however, the dry plate were turned over so as to have the film between the plates, the breadth of the band varied as the thickness of the upper plate. And in this case when the plate was placed in the developer, the band appeared first on the outer or upper side of the film.

It was found that fluorescence does not always occur when a diamond is drawn over a dry plate. Different diamonds and different brands of plates (glass) gave different results. To determine the cause of this apparent irregularity I made a series of observations, using ten different diamonds and nine kinds of plates. Seven of the diamonds were ordinary glass cutters, ranging in size from a very small stone in No. 1 (see table) to a large stone in plate glass cutter No. 7. Nos. 8, 9, and 10 were Brazilian black diamonds (in emery wheel cutters) known as carbonadoes. They appeared to be amorphous.

Ordinary plates, even the most sensitive, were not very sensitive to this fluorescence. Cramer, Stanley, Seed, Carbutt and Hammer plates were tried. Sometimes the diamond produced a slight fogging; usually it did not. In this respect no constant difference was noted in the different brands of plates.

To determine whether the quality or nature of glass influences fluorescence I asked the M. A. Seed Dry Plate Co. to supply me with plates of different kinds of glass coated with the same emulsion. The Company informed me that they were using four brands of glass, English, French, white crystal and American, and they sent me a supply of each kind coated with their most sensitive orthochromatic emulsion.

Their orthochromatic plate (No. 27) was found to be much more sensitive to diamond-glass fluorescence than the most sensitive ordinary plate. Fogging almost always occurred along the diamond trace, and the dark band was frequently very dense.

The following table embodies the results of the tests of different glass with different diamonds:

TABLE I.

Diamond.	Seed's orthochromatic plates, No. 27.								Seed's ordinary "Gilt Edge."		Total.
	English glass.		American.		French.		White Crystal.				
1. Small	trace	1	weak	2	trace	1	weak	2	absent	0	6
2. "	strong	4	absent	0	absent	0	weak	2	absent	0	6
3. "	strong	4	weak	2	trace	1	fairly strong	3	trace	1	11
4. Medium	strong	4	fairly strong	3	weak	2	fairly strong	3	weak	2	14
5. "	trace	1	trace	1	absent	0	weak	2	absent	0	4
6. "	trace	1	absent	0	absent	0	trace	1	absent	0	2
7. Large	trace	1	trace	1	absent	0	absent	0	absent	0	2
8. Carbonado	absent	0	absent	0	absent	0	absent	0	absent	0	0
9. "	absent	0	absent	0	absent	0	absent	0	absent	0	0
10. "	absent	0	absent	0	absent	0	absent	0	absent	0	0
Total		16		9		4		13		3	

Representing by numbers the relative intensities of the fogged bands, any total in

the last column is obtained by adding the intensities for the five kinds of plates and a single diamond. Similarly the last row represents the intensities corresponding to all the diamonds and one kind of glass. The table shows that the fluorescence depends upon the kind of glass, and also upon the particular diamond used. One would expect the former, and one might not be surprised that the black amorphous diamonds do not act as do the clear crystalline stones. But that the latter differ among themselves is strange. It was thought that the difference might be due to differences in shape and the character of the scratch. This conclusion was rejected when it was found that diamond No. 4 would always fog the plate, even when the surface of the plate was not scratched at all. When the diamond was held out of cutting position and drawn across a plate, a dark band appeared on development. Diamonds Nos. 5 and 6 could scarcely be made to fog a plate, however they were held.

That friction has much to do with fluorescence was shown by the fact that sometimes a dark band would be discontinuous in two or three places along a diamond scratch.

The band produced by No. 4 was so strong that it was thought the fluorescent light might be visible. This proved to be true. When the eye was rendered very sensitive by being in absolute darkness for an hour, the conclusions drawn from the table were verified directly. The fluorescence from No. 4 was very marked, especially when English or white crystal glass was used. No visible fluorescence could be obtained with any of the black diamonds.

To test the equation $b=2t.\tan i$ a dry plate was laid on a table, film upward. A plate of clear glass was then laid on the dry plate and a diamond was drawn across the clear plate. The mean of several measurements of b and t gave a critical angle of about 39°. For the particular plate used, this was approximately the critical angle for yellow light, showing that, whatever other wave-lengths might be present the longest waves that affected the film were those of yellow light. This conclusion was strengthened by the fact that, to the eye, the light appeared to be a greenish yellow, and that orthochromatic plates were much more sensitive to it than ordinary plates.

Measurements of b and t for plates of various thicknesses gave values of i ranging from 38.6° to 40.4°. It would seem that the fogged band should be much broader when the dry plate itself is scratched, for then the critical angle is determined by the ratio of the indices of refraction of gelatine and glass. Measurements did not confirm this point, though they showed a constant ratio between b and t.

Arthur L. Foley.

Physical Laboratory,
Indiana University.

---

*How Botany is Studied and Taught in Japan.**

Modern botany was practically introduced into Japan twenty-four years ago by the late Professor Yatabe,† who studied botany at Cornell University, graduating in 1876. He became the first professor of botany at the Imperial University of Tokyo. Before him there were several botanists in Japan who studied the native plants quite thoroughly. But most of them being amateurs, did not know much about modern botany. Some of these old botanists still live. The well-known Dr. Keiské Ito, who was the Director of the Botanical Garden of the University before Professor Ya-

* A paper presented at one of the Botanical Seminaries, Cornell University, November, 1900.

† Professor Yatabe was drowned in the sea at Kamakura not far from Tokyo in August, 1899.

tabe, still lives, being in his ninety-eighth year.*

A short sketch of his life, with a portrait, by his grandson Dr. Tokutaro Ito appeared in a late number of *Annals of Botany*. †

Professor Yatabe paid especial attention to systematic botany. Soon after his return from America he began to make a large and extended collection of the native plants, making long expeditions, especially in the summer vacation. It is to his arduous labors in collecting that the larger part of the herbarium of the Imperial University is due. He found and described many plants new to science. But his contributions are rather local and quite hidden from the general notice of many botanists. It is indeed only during the last few years that Japanese botanists have begun to contribute more or less to the general progress of the science.

I will now relate how botany is taught in the Imperial University of Tokyo. Before doing so, it is necessary to say how one must prepare before entering the University. A child goes to the common school at the age of six and remains there for from six to eight years before entering the high school. In the high school, English, mathematics, history, geography, physiography, physics, chemistry, zoology, botany, physiology, mineralogy, together with some Japanese and Chinese literature, are taught. This takes five years. English is the only foreign language taught in the Japanese high schools, except in one school in Tokyo where German is studied instead of English. This is the preparatory school for the medical department of the University.

If one wishes to enter the University one must spend three years after graduating from the high school in the higher high school (Kōtō gakkō). In the higher high school three different courses are given. The first course is required for the students of law and literature; the second is required for the students of science, engineering and agriculture, and the third for the medical students. The students of medicine are separately educated, as it is necessary for them to be thoroughly acquainted with German. In these three courses further subdivisions are made, according to the specialty of the student. If he is a student of botany, he is required to take the second course and to study botany, zoology, physics, chemistry, geology, mathematics, English, German, sometimes French or a little Latin, besides some Japanese and Chinese literature. After graduating from the higher high school he is admitted to the University without examination.

There are now two imperial universities in Japan, one in Tokyo and the other in Kyoto, the old capital of Japan. The latter was founded only three years ago and contains now the Colleges of Science, Engineering, Medicine and Law. No botanical department is yet established.

The Imperial University of Tokyo is divided into six colleges or departments: the Colleges of Science, Law, Literature, Medicine, Engineering and Agriculture, the last including Forestry and Veterinary Medicine. The College of Science is further divided into seven departments. These are physics, chemistry, mathematics, astronomy, zoology, botany and geology. All the courses of the University are required except a very few elective ones. Usually it takes three years to graduate, but in the departments of Law and Medicine four years are required.

The students of botany are required to study zoology, including histology and embryology, geology, paleontology, mineralogy, physiology, physiological chemistry and bacteriology, besides botany. In the first year they have three lectures a week on general botany (morphology and physi-

*Since this paper was read Dr. K. Ito has died (Jan. 24, 1901).

†Vol. XIV., No. 55, Sept., 1900.

ology) besides three laboratory hours. The laboratory work begins in identifying the various common plants, making drawings of each. In this work Gray's 'Manual', or 'School and Field Botany,' is often used, as we have no complete manual of Japanese botany. Next comes the gross and minute anatomy from the lower to the higher plants. Especial attention is paid to the various kinds of tissues, often referring to the comparative anatomy and development, together with some microchemical reactions of more common cell-contents. In the third term especial attention is paid to fertilization, embryology and development. The fern and *equisetum* are studied from the germination of the spore to the formation of sexual organs on the prothallia. The fertilization of pine and *gingko* affords good objects for study. Cell-divisions are often studied with the root-tip of beans, pollen mother cells of *Tradescantia*, lilies, etc.

In the second year three lectures on systematic botany are given weekly and three laboratory hours are devoted to plant physiology throughout the year. Various experiments on carbon assimilation, respiration, transpiration, geotropism, heliotropism, rheotropism, hydrotropism, etc., are made. Growth is observed with various auxanometers and horizontal microscopes. Then micro-chemical studies of various important cell-contents, including the inorganic salts are made. Their distribution and the transformation within the plant bodies are then studied. Artificial pure cultures of various algæ, fungi, bacteria and yeast are made, paying special attention to the nutrient value of various organic and inorganic compounds. Water cultures of the higher plants are also made. Chemotropism of the pollen tube, fungal hyphæ and chemotaxis of bacteria are carefully studied. Regeneration of the liverwort thallus and the dandelion root, nodal growth of Gramineæ are the other objects of study. *Tradescantia* cell with its red-colored sap affords excellent material for studying the osmotic pressure in the cell. Isotonic coefficient of various organic and inorganic substances are determined according to the method of de Vries. In the third term, sometimes a special subject of study, being either original or a repetition of the previous work, is given to each student.

In the third year the only required studies are: one hour's lecture weekly on plant physiology during the first term, and one lecture and two laboratories on bacteriology during the second term. The rest of the time is spent in the work of graduate theses. Subjects of theses are mostly physiological or anatomical. Following are the subjects of theses presented to the University by the graduates in botany in the last three years:

1898.

T. Inui. 'Anatomy and physiology of the gum-resin duct of lac-tree and the other species of *Rhus*.' (English.)

1899.

K. Shibata. 'Contribution to the physiology and anatomy of bamboo.' (German.)

N. Ōno. 'On the acceleration of growth in some algæ and fungi by chemical stimuli.' (German.)

H. Hattori. 'Studies on the action of copper sulphate upon plants.' (German.)

S. Kusano. 'On the transpiration of evergreen trees during winter in middle Japan.' (English.)

K. Miyaké. 'On the carbon assimilation of evergreen leaves in Tokyo and other parts of Japan during winter.' (English.)

1900.

K. Saitō. 'Anatomical studies of Japanese fiber plants.' (German.)

Y. Yabé. 'A revision of the Umbelliferæ of Japan.' (Latin.)

The chief results of the above-mentioned

theses, except that of Mr. Yabé, are already reported in the *Botanisches Centralblatt*,* by Professor Miyoshi. Some of them have already been published, and the rest will be published soon.

In the graduate course no lectures are given. By presenting a thesis which represents five years' study after graduation the degree of 'Rigaku hakushi' (Doctor of Science) is given. Of these five years the first two must be spent at the University. There are now seven students in the graduate course of botany, one of them studying outside of the University. Their subjects of study are mostly in the lines of plant physiology and physiological anatomy.

At present there are two professors and three assistants in the Botanical Department. Professor Matsumura, who is the head of the department and the director of the Botanical Garden, has charge of systematic botany. He studied in Germany under the late Professor Sachs, in Würzburg, and Professor Pfitzer, in Heidelberg. Professor Miyoshi is the professor of plant physiology. He graduated from the Imperial University and afterward studied in Professor Pfeffer's laboratory at Leipzic for three years. He is the well-known worker on the chemotropism of fungi.

Professor Matsumura is now studying the flora of the islands of Formosa. The results of his study have been partly published. Professor Miyoshi is engaged in investigating the coloring matter of flowers, besides other physiological studies. Mr. Fanjii, the assistant, who has occupied this position for several years after graduating from the University, is making researches along morphological and ecological lines. Mr. Makino, an assistant, is now studying the difficult group of bamboo, besides his systematic researches on Japanese phanerogams and ferns.

* *Botanisches Centralblatt*, Bd. 80, No. 5, 1899, and Bd. 83, No. 11, 1900.

The Botanical Laboratory is situated in the Botanical Garden. The Botanical Garden is more than two hundred years old. The garden was used primarily for medicinal plants, but now it has many kinds of Japanese and foreign plants. There is also a large green-house. The herbarium of the Botanical Laboratory contains nearly all the Japanese plants, including tropical plants from the islands of Loochoo and Formosa, besides some exotic plants. The cryptogamic herbarium is not yet completed, as many of the lower forms are not well studied. The library of the laboratory contains the leading German, French, English and Italian journals. Zeiss microscopes are commonly used in the laboratory.

There is another botanical laboratory in the College of Agriculture. Professor Shirai has charge of plant pathology and dendrology. He is especially interested in fungi and the plant diseases. He is now studying in Berlin. Professor Ikeno, the well-known investigator of *Cycas*, is giving the lectures on plant morphology and physiology. He is engaged on investigations in histology and cytology. The leading English, German and French botanical journals are also found in this laboratory.

The botany in the higher high school in Tokyo is taught by Dr. Goto, who is a zoologist. In the Higher Normal School of Tokyo, Professor Okubo has charge of the Botanical Laboratory. Professor Miyoshi, of the Imperial University, is now giving the lectures on plant physiology during the absence of Dr. Saida, who is in Germany.

In the Agricultural Experiment Station of Tokyo there are several botanists. Mr. Hori, the chief botanist, has charge of vegetable pathology. Various kinds of plant diseases are constantly studied here. The disease of the mulberry tree, the leaves of which furnish the food for the silkworm, were the special subject of investigation during the last few years by a special com-

mittee. The cause of the disease is found to be physiological, not caused by any organism, as it was thought before. A remedy for the disease is still being investigated.

There are several botanists in Tokyo outside of the above-mentioned institutions. Dr. Okamura, who is the lecturer of the Fishery Institute of the Government, is making continued studies on the marine algæ of the Japanese seas. He has just issued the first fasciculus of his 'Algæ Japonicæ Exsiccatæ,' which contains fifty species. Dr. T. Itō, who studied botany at the University of Cambridge some fifteen years ago, is making extensive systematic studies on the flora of Loochoo islands. A part of the work was published in a late number of the Journal of the College of Science, Imperial University of Tokyo.

The works of the Japanese botanists are often published in the Journal of the College of Science, Imperial University of Tokyo, as well as in the leading foreign journals. The shorter papers appear in the *Botanical Magazine*. The magazine is published monthly, partly in Japanese and partly in the European languages. It is the organ of the Tokyo Botanical Society. The Society has about three hundred members, living in various parts of Japan. Among them we find many high and common school teachers. There are two series of small pamphlets published monthly with figures and descriptions of Japanese plants. One contains figures, with brief descriptions and remarks of the flowering plants and ferns of Japan. The other contains those of the lower cryptogams. The illustrations and descriptions in the former are made by Mr. Makino. The latter is contributed to by many Japanese botanists and edited by Professors Matsumura and Miyoshi.

A still larger work on Japanese botany has just begun to be published. This is the 'Icones Floræ Japonicæ,' a large-sized pamphlet with minute and careful drawings and descriptions of Japanese plants, compiled by the Botanical Department of the University. Volume I., Part 1, has lately been published. Mr. Makino is now engaged on the work. All the drawings and descriptions are made by his own hand.

In closing I must not neglect to make a brief statement of the Botanical Laboratory in the Agricultural College of Sapporo far north in 'Hokkaido,' the Yezo Island. The director of the Botanical Laboratory and the Botanical Garden is Professor Miyabé. He studied at Harvard University some ten years ago. The herbarium of the Laboratory has a complete set of the plants of the Yezo Island, besides other Japanese and foreign plants. Professor Miyabé is interested in fungi and plant diseases. Several works in this line have been done both by him and by his students. Professor Miyabé also studied the Laminariaceæ of the northern seas. Two new genera have been established by him in this single family.

Japan is a long country, though narrow, extending from 51° north to the tropics. The variety and richness of the flora are incomparable. Though the phanerogams and the ferns of the empire are pretty well known, many lower cryptogams have not been thoroughly investigated.

Krichi Miyaké.

Botanical Department,
Cornell University.

SCIENTIFIC BOOKS.

Reservoirs for Irrigation, Water Power, and Domestic Water Supply. By James Dix Schuyler, M.Am.Soc.C.E., etc., etc. New York, John Wiley and Sons, 1901. $5. Pp. xvi + 414. 174 figs., with maps and appendix.

The subject of reclaiming by irrigation the extensive arid tracts of western North America is pressed upon the attention of the general public, and also upon that of the engineering and financial world, with increasing emphasis from year to year. Private capital is urged to

provide reservoirs and irrigation works and has already done so to some extent, and the question of aid from the national government in extending the work is under debate. Much light is shed upon what has already been done in this direction, as well as upon what is proposed and is under way, by Mr. Schuyler's interesting book, which embodies the material used in his reports to the U. S. Geological Survey in 1896 and much additional matter of more recent date.

The book is unquestionably a valuable one for civil engineers, giving, as it does, a description of the principal dams built, and now projected, in the western portion of the United States; and also some account of large dams in foreign countries, already completed or in progress, such as those at Assuan and Assiout in Egypt; giving also (to quote from the title page), "A discussion of the available water supply for irrigation in various sections in arid America; the distribution, application, and use of water; the rain-fall and run-off; the evaporation from reservoirs; the effect of silt upon reservoirs," etc. In some cases details are presented in great fullness; and illustrations, views, profiles, maps and plans occur in profusion throughout the work, thus greatly enhancing its value. As an instance in point, it may be noted that in the description of the Sweetwater dam, in southern California, built after the design, and under the superintendence, of Mr. Schuyler himself, there are fourteen distinct illustrations (views at different stages of construction, sections, maps, etc.), the description itself occupying seventeen pages.

This same dam offers a striking instance of the benefits obtained by the erection of such a structure. During the thirteen irrigation seasons up to 1900 'the impounded water has created values aggregating several millions of dollars, reckoning all improvements made in the district directly dependent on it for water supply.' Domestic water supply is also furnished to a population of from 2,500 to 3,000 people. The cost of the dam was $234,000 and the area at present irrigated from it is 4,580 acres.

The dams described are classified according to their mode of construction and may be briefly referred to as follows:

'*Rock-fill*' dams are composed of stones deposited loosely together in a trapezoidal form, water-tightness being provided by a sheathing of plank on the upper side, or by an earth facing. This plan originated some fifty years ago in the mining regions of California, when the transportation of cement into remote districts was very expensive, or impracticable. Later construction employed a concrete 'skin' on the upper side; or a central and vertical steel plate, covered on both sides with hot asphalt and burlap, and then imbedded in a wall of concrete. Sometimes the steel plates formed a facing on the upper side.

The '*hydraulic-fill*' dams were composed of earth and gravel deposited by 'sluicing' the material into position; that is, by washing down the soil by jets of water from higher elevations in sluices or pipes into the desired position. In this way, by proper management, the finer soil could be made to occupy the center of the dam or embankment, while the coarser gravel and stones formed the outer portions; and extreme cheapness of construction was often attained. Thus, the Tyler dam, in Texas, 575 ft. long and 32 ft. high, cost only $1,140; including the expense of pumping water to form jets for loosening and sluicing the soil. As the water drains off gradually the gravel, sand and clay are more compacted, it is claimed, and hence a more water-tight dam obtained, than if the material had been laid dry and then tamped.

Naturally, the chapter on the masonry dam, as being the most durable and stable construction, occupies a greater space in the book than any other. Here the usual arguments are presented in favor of the gravity dam, as against the horizontal arch; though the curved form is advocated in certain cases for esthetic reasons, and as providing for remote contingencies. A full description is given of that 'eighth wonder of the world,' the noted Bear Valley dam, in California, which with its very slender dimensions depends for stability solely on its arched form; this form having been given to it to effect a saving in the cost of masonry, since the cost of hauling cement to the locality was at that time (1884) $10 per barrel. The Sweetwater dam, already mentioned, belongs to this

class and was built in 1888. An interesting fact with regard to sedimentation in this reservoir is that during the twelve years of its use the bed of accumulated silt in the deepest part (some 90 ft.) was only 3 ft. in thickness. This is in great contrast with the rapid silting of Lake Macdonald, the reservoir created by the Austin dam of Texas, whose design and construction, and also final failure in April, 1900, are described by Mr. Schuyler.

Concrete dams are next taken up, including the structure of that type built for the Hydraulic Laboratory of Cornell University; in connection with which an account is given of the device adopted for 'concentrating the contraction due to temperature changes in the concrete to a central point of weakness.' The resulting fissure was filled up in cold weather and continuity thus secured.

In the chapter on earthen dams mention is made of the ancient 'tanks' or storage basins, of Ceylon, one of which was closed in by an embankment 11 miles in length and 200 feet high; also of several in India. The other earthen dams mentioned are in Colorado and California, one of them (5.5 miles in length) serving to close in the Buena Vista Lake Reservoir, which has great extent (25,000 acres) but is only about 7 feet deep. As a result of this, the annual loss of water by evaporation is estimated at 70 per cent. of its capacity. However, when the evaporation is most active, the loss is made good continuously by the influx from the river.

The Ash Fork steel dam in Arizona, described on p. 222, was erected in 1897 and is an unusual construction, consisting of a number of vertical steel frames or trusses, connected or 'bridged over' at the upper side by curved plates of steel which form a continuous and water-tight covering. The structure is 33 feet high, 184 ft. long, and cost $45,000.

Natural reservoirs are next mentioned; *i. e.*, ready-made reservoirs or depressions, waiting only for water to be turned into them from neighboring streams of sufficient elevation and for suitable provision for its regulated escape.

The last chapter, on 'Projected Reservoirs,' is of considerable length and full of detail, treating of many irrigation surveys and projects for impounding water, throughout the Western States and Territories. Several of the structures mentioned are already in process of construction. An appendix of various tables made for the U. S. Geological Survey, and contoured maps of reservoir systems, complete the work.

A very commendable feature of Mr. Schuyler's book, and one that will be appreciated by civil engineers, is the information given as to the *cost* of many of the dams and other structures described in the work.

I. P. Church.

Annual Reports of the War Department: Report of the Chief of Ordnance. Washington, Govt. Print. 1900. 8vo. Pp. 474. Numerous appendices and plates.

The reports of the War Department always contain much of interest to the general reader and to the thoughtful citizen, apart from their purely technical matter, as, for example, the accounts of work performed under the River and Harbor Bill. Those of the Chief of Ordnance are particularly interesting to the student of metallurgy and to the engineer as giving much valuable information regarding materials. Occasionally a side-light is thrown upon interesting phases of governmental and official administration; as where the report of the chief of a bureau permits the reader to see the hand of the politician in the determination of the location of important locks, in river improvements in the West and the reason for the displacement of a worthy and capable officer insisting upon correct business methods, or where, as in the report before us, the official documents reveal the fact that a Committee of Congress, composed mainly if not entirely of non-experts, or amateurs at best, decides to 'try an experiment' with Government funds, to the extent of many thousands of dollars, directly against the expressed opinion of the official expert advisers of the Department and of Congress, or where official and expert authorities are permitted to be accused of refusing to permit the civilian expert reasonable opportunity to display his talent, and the charge is left without complete and decisive investigation and report. Amateurism is not altogether a monopoly with departments.

The Report of the Chief of Ordnance, proper, is a very brief, business-like and well-condensed summary of the operations of the bureau for the fiscal year ending June 30, 1900, covering 42 pages of the volume. The details of the work are exhibited in the remaining four hundred pages, in which are given forty appendices, mainly reports of officers charged by the Bureau with important duties and including the operations of the various arsenals.

Watervliet Arsenal, for example, has turned out during the year 45 ten- and twelve-inch rifles and mortars, and five smaller rapid-fire guns, and has made a large quantity of accessory material. Springfield Armory made about 60,000 army rifles and carbines and attained an output of 400 guns a day. Working eight hours a day, it now turns out about 200. As usual, a large amount of experimental work has been performed. Watertown Arsenal has been engaged upon sea-coast gun-carriages and its great testing-machines—it now has one of 200,000 pounds capacity, in addition to the older machine of 80,000 pounds—have performed a considerable amount of valuable scientific work in addition to that of the routine operation of the Department. Frankford Arsenal has made, during the year, 23,000,000 small-arm cartridges and can now issue about 90,000, per day of eight hours, continuously. Rock Island Arsenal turns out most of the infantry and cavalry equipments of the army. It makes blanket-bags at from $1 upward, haversacks at from 85 cents, canteens at 32 to 38 cents and tin cups cost but 10 cents to make. Costs have come down and wages gone up with the use of improved machinery. A new small-arms factory is under construction here, to produce 200 to 250 guns a day. Heavy guns for fortifications have been so extensively supplied that the Department is now turning its attention to the smaller rapid-fire guns. A muzzle velocity of 3,000 feet per second is to be attained in the later construction.

Wire-wound guns continue a subject of experiment, but still without complete success. It has come to be a question whether the disappearing gun-carriage for heavy mounts is best practice and whether it has not been too exclusively adopted. The Bureau does not express a decided opinion on this point. The automatically operating rapid-fire gun is reported upon and recently invented automatic pistols are the subject of investigation, with the result of choice of the Colt construction for army use, if later approved by the Department.

Interesting investigations of the composition of acceptable gun-steels give the valuable deduction that for an elastic limit of 70,000 to 75,000 pounds per square inch, and a tenacity of 100,000, with an elongation 15 to 20 per cent., the compositions should include about one-half of one per cent. carbon, one per cent. manganese, one-fifth to one-tenth per cent. silicon, and well under one-tenth of one per cent. of sulphur or phosphorus. Oil-tempering is not of advantage. Rolling is best performed at a temperature a little way below that of the blue 'critical heat.' One curiously interesting deduction is that the action of smokeless powder, or other high explosive, attaining a given pressure in the barrel of a gun, is less destructive than a similar pressure produced by ordinary static testing. The duration of the pressure is about 0.0004 second only, and time is thought to have an important influence upon results. The normal powder pressure in the army rifle is about 42,000 pounds per square inch. The singularly interesting phenomenon, extensively investigated by the writer many years ago, 'the exaltation of the normal elastic limit by strain,' * finds application here, as in so many other matters of applied science; the practice being now established of rolling and forging parts at a minimum temperature to insure high elastic limits and maximum tenacity.

R. H. THURSTON.

Experimental Psychology. A Manual for Laboratory Practice. By EDWARD BRADFORD TITCHENER. Volume I. Qualitative Experiments; Part I. Student's Manual. Pp. 214. Part II. Instructor's Manual. Pp. 456. New York, The Macmillan Co. 1901.

The place of laboratory practice in the teaching of psychology has, in American universities at least, become assured. It is by no means

* *Trans.* A. S. C. E., 1873. 'Materials of Engineering,' Vol. II., Chap. X.; Vol. III., Chaps. XIII., XIV.—R. H. T.

settled in method, mode of instruction, arrangement of the work, or indeed of the principal aims to be accomplished. There has been too little time for any usage to become traditional or classic; and individual solutions of the important as well as of the incidental problems have been the unavoidable rule. Such usage is likely to become established through the influence of laboratory manuals more easily than through any other source. Sanford's manual is the pioneer in this field, and has been available in various stages of incompleteness for five years or more. Cattell maintained an attractive announcement in a publisher's list for some years; but this was withdrawn on the publication of Sanford's book. Scripture has published some helpful notes on the conduct of experimentation in the psychological laboratory; Höfler and Witasek have recently published a book of *Schulversuche;* and other sporadic contributions to special parts of this topic may be found by the industrious seeker. Professor Titchener's volumes form a weighty addition to this small group of pedagogical aids, and one certain at once to take high rank and to have an important part in the shaping of experimental usage in psychology.

The plan of the work covers two volumes; the first devoted to qualitative experiments, the second to quantitative experiments. These, again, will appear in two forms; the one for the students and the other for the use of the teacher. The present two volumes include the qualitative experiments for the student and for the instructor. It is, therefore, as yet premature to judge of the scope of the completed work; but the architectural principles upon which it is reared are sufficiently represented in this first portion to enable one to intelligently estimate the place which the whole is to occupy in the literature of psychology. The student's manual proceeds, after a brief introduction on the general arrangement of experimentation, to consider sensation (six chapters, including the five senses and organic sensation), the affective qualities, attention and action. Then follows a consideration of the rôle of perception, and the association of ideas—falling into chapters on visual space perception, auditory perception, tactual space perception, ideational type and the association of ideas. This range of matter is grouped in thirty-seven experiments, many of them rather complex in character and involving a considerable number of separate observations. The experiments are clearly and suggestively elaborated, the instructions lucid, the emphasis laid on the interpretation of the results commendable. There are numerous illustrations, and the mechanical features of the volume leave nothing to be desired. The work represents the result of many years of experience of an experimental psychologist who emphasizes, as markedly as any of his colleagues, the importance of laboratory practice, and has evolved for his own use as comprehensive a system as is in vogue in any laboratory of psychology. The scholarly character of the result, the authoritativeness of the positions therein embodied, are unmistakable. Every director of a laboratory of psychology, small or large, will find much direct aid and more indirect suggestion in this newest manual.

The central question, upon which there is likely to be a marked difference of opinion, relates to the plan of the work and its adaptability to the several needs and facilities of the university and college courses in psychology. The division of the work into a qualitative and a quantitative part is evidently fundamental in the author's conception. Sanford's manual combines the two in a serial treatment of topics. How the two camps will divide it is not easy to foresee; for though we may hold that pedagogy is a science, it does not give unambiguous answers to such queries. The analogy to chemistry is at once suggested. But in chemistry there is in the main only a repetition of the one analysis with added mathematical factors; this seems hardly the case in psychology. The separation of the two in chemistry introduces no sense of incompleteness; and for introductory instruction, the one has a traditional and well-founded prestige. Neither fact is true of psychology. The practical question of economy of time and advantage in going over the ground once qualitatively and again quantitatively will deter many from introducing this practice even if they favor it upon logical grounds.

The present writer, after weighing the pros and cons both of a theoretical and of a practical

sort, must decide for his own part in favor of a topical treatment in which qualitative and quantitative analyses are conjointly used and regarded as methodical aids to the elucidation of principles and the determination of results. As in physiology we consider first the bony system, then the circulatory, then the nervous system, and so on and in the end and all the way through keep in mind the mutual interrelations of these systems, and introduce quantitative determinations so far as they aid the comprehension of the functions considered; so in psychology there is good ground for considering that the greatest pedagogical success and the clearest insight into the significance of mental phenomena will be reached by the pursuance of a similar method of exposition. For those of this opinion, it will still be possible to use the qualitative and quantitative parts together, though with some readjustment of method. Another marked characteristic of the manual is the selection of a relatively few groups of experiments and the careful elaboration of these. In this an exemplar may be found in the usage of many laboratories of physics. In the unsettled status of psychological practice this point is also likely to be favored by some and rejected by others. The principle involved is this: How far shall an experiment represent a verification by each individual of the essential facts of a given principle or trait of mental processes? or shall it be a miniature reestablishment of the method and the evidence which led to the formulation of that principle? Sanford adopts the former plan, Titchener the latter. Again, both practical and theoretical considerations will affect one's decision; that the former practice is the more readily assimilated to the ordinary practice courses of our universities admits of little doubt. These, then, are some of the differences of route which the psychological tourist will encounter; and he must choose his own guide and take the benefits and losses that result from his choice. Which is the easier road to travel, which affords the better outlook, experience alone will decide. It is fortunate that our psychological guides, in this case, are animated by the best of motives and equipped with admirable training for their tasks.

Both Sanford's and Titchener's manuals are adapted to the student with a marked and well-grounded interest in the work. They are manuals for 'long course' specialized students. There is still an urgent need for a more elementary manual that will cover a small number of carefully selected experiments in a way suited to the 'short course' students. Such seems to have been promised by the announcement which Cattell withdrew, and is in a measure accomplished by the German manual above referred to, and may be approximated by a judicious selection and reconstruction of Sanford's experiments. While welcoming a new and important aid to the teaching of experimental psychology, this need, that is still to be satisfied, may be appropriately noted.

The instructor's manual is a complete innovation in the literature of psychology, and one to be highly valued. It is to be understood that this is an entirely different book from the other, though necessarily following the same order of experiments and the same unfoldment of topics. Yet the text is addressed to the director of the experiments; he is given a complete account of the sources of error, and the precautions to be followed in the conduct of the experiment, is referred to the appropriate literature, and to more exact apparatus and observations not suited to student use. This, indeed, is in many ways the most valuable portion of the work. It makes possible for the first time the systematic training of the assistant by the director of the laboratory, and gives the special student in experimental psychology a reliable and methodical guide to the problems with which he is in the main to be concerned. The use of this manual as a basis of a special course for advanced students, in training to become professional psychologists, is one of its possibilities apart from its primary function. Professor Titchener has here placed at the disposal of his colleagues the result of years of very special and successful devotion to the problems of psychology susceptible to treatment by the experimental methods, and for this service so admirably accomplished he is entitled to the honors and privileges attaining to the distinction of carrying through so difficult and important a piece of pioneer work.

It is in the instructor's manual, likewise, that the spirit of the author's laboratory methods comes more clearly to the foreground. The presentation is more intimate, the descriptions more comprehensive, and the insight into the training which the course is intended to give more manifest. The genial set of instructions headed 'How to Fail in Laboratory Work,' might serve a good purpose if prominently exhibited in the laboratory. But the main point to be noted is the thorough appreciation of the fact that the psychological experiment carries with it its own conditions and peculiarities; that in becoming a 'subject' the individual retains all his peculiarities; and that these must be dealt with by tact and resource. The difference between good and bad observation upon mental matters depends upon this, almost equally with the acquaintance with method and technique. Both for the method and the matter, these volumes and the two to follow must be valued as amongst the most important of recent contributions to the furtherance of the aims of experimental psychology.

JOSEPH JASTROW.

Peach Leaf Curl: Its Nature and Treatment. By NEWTON B. PIERCE, in charge Pacific Coast Laboratory, Santa Anna, California. Bulletin No. 20, Division of Vegetable Physiology and Pathology, U. S. Department of Agriculture. Washington, Government Printing Office. 1900. Pages 1–204; plates I.–XXX.

A carefully detailed and exhaustive account of the geographical distribution, history, horticulture, botany and pathology of this destructive disease, and of experiments with the various remedies, methods and appliances for treating it. The most important of the conclusions is that very large percentages of the injuries due to the parasitic fungus *Exoascus deformans* are not caused by the renewed growth of perennial mycelium, but are the result of new infections occurring in early spring, and thus preventable by spraying the still unopened buds with Bordeaux mixture or other fungicides. Previous failures with such treatments are explained by the fact that the remedy was applied after the pathogenic organism had hidden itself in the tissues of its host.

As the annual losses from leaf curl in the United States are estimated at $3,000,000, the determination of these simple points is of great economic importance, and also of the widest interest, since this disease, unlike the yellows, extends to all regions where the peach is cultivated.

BOOKS RECEIVED.

Select Methods of Food Analysis. HENRY LEFFMANN and WILLIAM BEAM. Philadelphia, P. Blakiston's Son & Co. 1901. Pp. viii + 383. $2.50.

L'evolution du pigment. G. BOHN. Paris, G. Carré and C. Naud. 1901. Pp. 96. 2 fr.

Towers and Tanks for Water Works. J. N. HAZLEHURST. New York, John Wiley & Sons; London, Chapman & Hall. 1901. Pp. ix + 126.

SOCIETIES AND ACADEMIES.

AMERICAN MATHEMATICAL SOCIETY.

A REGULAR meeting of the American Mathematical Society was held at Columbia University, New York City, on Saturday, April 27, 1901. About thirty-five persons attended the two sessions. Vice-President Thomas S. Fiske occupied the chair. The following persons were elected to membership: Mr. C. W. McG. Black, Yale University; Dr. S. E. Slocum, University of Cincinnati. Two applications for membership were received.

To relieve the increasing burden of administration, the office of Assistant Secretary was created and filled by the appointment of Dr. Edward Kasner, to serve until February, 1902.

The library of the Society, which at present consists mainly of some five hundred unbound volumes of journals received as exchanges, is about to be deposited in the library of Columbia University, under an agreement by which the University undertakes to bind, catalogue and care for the books now on hand and all future additions, and to make them easily accessible to the members of the Society. Arrangements will be made by which the books may be temporarily loaned to members living at a distance. The library is to be kept as a separate collection, duplicating as far as may be the general University library, and aiming to become as complete as possible in itself. The title to the books remains in the Society, which reserves

the right to withdraw them under agreed conditions.

The following papers were presented at this meeting:

Dr. W. A. GRANVILLE: 'Invariants of some m-gons under certain projective Lie groups in the plane.'

Dr. EDWARD KASNER: 'The algebraic potential surfaces.'

Professor F. MORLEY: 'On the real foci of algebraic curves.'

Mr. GEORGE PIERCE: 'A curious approximate construction for π.'

Professor E. W. HYDE: 'On a surface of the sixth order which is touched by all screws belonging to a three-conditioned system.'

Professor L. E. DICKSON: 'The hyper-orthogonal groups.'

Professor E. W. BROWN: 'On least action and minimal surfaces.'

Professor W. H. METZLER: 'On certain aggregates of determinant minors.'

Professor E. B. VAN VLECK: 'On the convergence of continued fractions in the complex elements; supplementary note.'

Professor W. F. OSGOOD: 'On a fundamental property of a minimum in the calculus of variations.'

Professor E. O. LOVETT: 'The geometry of quadrics.'

Professor E. O. LOVETT: 'The differential geometry of n-dimensional space.'

Dr. G. A. MILLER: 'On the groups generated by two operators.'

Dr. EDWARD KASNER: 'The relations between the angles of any number of lines in n-space.'

Dr. L. P. EISENHART: 'Isothermal conjugate systems of lines on surfaces.'

Dr. E. J. WILCZYNSKI: 'Geometry of a simultaneous system of two linear homogeneous differential equations of the second order.'

Dr. H. F. BLICHFELDT: 'A new determination of the primitive continuous groups in two variables.'

The summer meeting and colloquium of the Society will be held at Cornell University, Ithaca, N. Y., beginning August 19, 1901, and extending over a week.

EDWARD KASNER,
Assistant Secretary.

ZOOLOGICAL JOURNAL CLUB OF THE UNIVERSITY OF MICHIGAN.

AT the meeting of January 17th, Professor Jacob Reighard gave a paper on 'The Behavior of Plankton Nets.' This was based on plankton work done on Lake Erie in 1899 and 1900, in company with Professor H. B. Ward, under the auspices of the United States Fish Commission. The amount of water strained by the nets was directly measured by the use of a meter. It was thus possible to determine accurately the coefficient of the nets under various conditions, to judge as to their constancy, and to decide as to the correctness of the coefficients calculated by other investigators. The results have a fundamental bearing on the worth of all plankton work hitherto done; details will be published in a paper now under preparation.

January 24th, Mr. Raymond Pearl gave an account of work on the 'Electrotaxis of Infusoria.' The paper was accompanied by demonstrations with the projection apparatus. The following demonstrations were given:

1. The reactions of Paramecium to the current. The orientation and movement toward the kathode in a weak current were first shown. Then by a gradual increase in the intensity of the current the speed of swimming was made to decrease, and in a very strong current the characteristic changes in body form were seen to occur.

2. The reactions of a species of *Oxytricha*, one of the *Hypotricha*. It was seen that on making the current a part of the animals immediately oriented and went toward the kathode, while others swam in an oblique direction more or less transverse to the current. Attention was called to the fact that during the transverse swimming the animal often jerked sharply to one side, the direction of this jerk always being the same—that is, toward the right side of the organism. It was shown that by this process of frequently jerking toward the right side while swimming obliquely, orientation with the anterior end toward the kathode was ultimately brought about. It was pointed out that the reason why a part of the animals oriented at once, while others did so only in the indirect way thus described, was owing to the different position of the axes of the body with reference to the anode and kathode at the time of making the current. When the long axis of the body was transverse to the direction of the current and the oral side was toward the kathode, the transverse or oblique swimming

occurred, while from all other positions immediate and direct orientation with anterior end toward the kathode followed the closing of the circuit. On reversing the current, it was seen that the animals always gained the new orientation with anterior end to the new kathode by turning to the *right*. The fact was shown that sudden breaking (as well as reversal) of the current always caused the typical motor reflex that is given by the organism as a response to stimuli of other sorts—the animal always turning to its right.

3. The kataphoric effect of currents of moderate intensity in carrying *Chilomonas* and suspended particles in the water toward the anode was shown.

Following the demonstrations an account was given of the electrotactic reaction of a number of infusoria, and the bearing of the results on the recent work of other investigators was discussed. Reference was made to the reactions of some of the lower Metazoa which resemble in many ways the reactions of the infusoria.

H. S. Jennings,
Secretary.

DISCUSSION AND CORRESPONDENCE.

CORRECTION TO ANDRÉ'S ASTRONOMIE STELLAIRE.

The favorable notice of André's 'Traité d'astronomie stellaire' contained in the number of Science for April 19, 1901, leads me to call attention to the following curious error contained in that work, which appears to have escaped the notice of all its reviewers.

In Vol. I., § 225, the author seeks to account for the well-known fact of a progressive variation in the periodic time—interval from minimum to minimum—of certain variable stars, and resorting to the hypothesis of a uniform motion in the line of sight, he proceeds by elementary mathematical methods to derive the effect of this motion in altering the periodic time of the light variations. It is almost self-evident that the effect of this motion is to produce a small but constant difference between the true period, and that furnished by observation, and this result is confirmed by the author's analysis when properly executed. But at the equation marked (2) in the text, André commits the algebraic error of dividing two terms of his equation by a certain factor, $n' - n$, while neglecting to divide the third term and obtains thereby an erroneous result which he interprets, correctly enough so far as the equation itself is concerned, as showing that the star's radial velocity produces a progressive change in the periodic time of its light variations. He applies this equation to certain well-known variables having secular terms in their light equations, and derives from purely photometric data, numerical values for their motion in the line of sight, which, although plausible enough in respect of magnitude, are entirely wrong in principle. The entire section entitled 'Terme séculaire' should be suppressed since it is completely vitiated by the algebraic error noted above.

George C. Comstock.

AN APPEAL FOR COOPERATION IN MAGNETIC AND ALLIED OBSERVATIONS DURING THE TOTAL SOLAR ECLIPSE, MAY 17-18, 1901.

To further test the results obtained by the United States Coast and Geodetic Survey during the total solar eclipse of May 28, 1900, arrangements are being made for obtaining simultaneous observations of the magnetic elements and of allied phenomena over the entire globe during the next total solar eclipse, May 17–18, 1901.*

* CIRCUMSTANCES OF THE ECLIPSE.

	Greenwich Mean Time.				Longitude from Gr.			Latitude.		
Eclipse begins	May 17 d.	14 h.	59 m.	.9	51°	34′.4	E.	20°	21′.9	S.
Central eclipse begins	17	15	57	.6	40	11 .2	E.	27	27 .6	S.
Central eclipse at noon	17	17	28	.8	96	51 .9	E.	2	07 .1	S.
Central eclipse ends	17	19	10	.2	156	53 .6	E.	12	49 .0	S.
Eclipse ends	17	20	07	.9	145	04 .5	E.	5	38 .0	S.

To make the investigation exhaustive, an earnest appeal is herewith made to all persons who have instruments at their disposal to participate in the proposed observations and to put themselves in communication with the Division of Terrestrial Magnetism, U. S. Coast and Geodetic Survey, Washington, D. C., so that the necessary directions may be given them.

The scheme of work proposed embraces the following:

1. Simultaneous magnetic observations of any or all of the elements, according to instruments at the observer's disposal, every minute from May 17, 14 h. to 21 h., Greenwich mean astronomical time.*

[To insure the highest degree of accuracy attainable, the observer should begin work early enough to have everything in complete readiness in proper time.†]

2. At magnetic observatories all necessary precautions should be taken, so that the self-recording instruments will be in good operation, not only during the proposed interval, but also for some time before and after, and eye-readings should be taken in addition, wherever circumstances will permit.

3. Such meteorological observations as are possible for the observer should be made at convenient periods (as short as possible) throughout the interval. It is suggested that temperatures, *e. g.*, be read every fifth minute (directly after the magnetic reading for that minute).

4. Observations of atmospheric electricity and of earth currents should be made wherever possible, and any other phenomena of importance should be fully noted.

The request is made that observers send, as soon as possible, a full report of their work to the Superintendent of the Coast and Geodetic Survey.

L. A. BAUER.

*For America this interval occurs during the night hours of May 17th and 18th, civil dates, while for Europe, Asia, Africa and Australia, it occurs during the morning or afternoon hours (according to longitude of station) on May 18th, civil date.

†See directions followed by the Coast and Geodetic Survey during the recent eclipse, Journal 'Terrestrial Magnetism,' Vol. V., p. 143.

CLAYTON'S ECLIPSE CYCLONE AND THE DIURNAL CYCLONES.

IN a letter with the above title, in SCIENCE of April 12th (N. S., Vol. XIII., p. 589), Professor Bigelow criticizes my papers on the 'Eclipse Cyclone and the Diurnal Cyclones.' His criticism is subdivided into two heads: (1) concerning 'some minor errors' which he thinks he finds in the formulas, and (2) concerning the theory of the cold-center cyclone.

My method of treating the winds observed during the eclipse was first to find the mean wind during the eclipse at each station, then to find the deflections of the observed wind from this mean at intervals during the eclipse, in order to see if there were any systematic changes which might reasonably be attributed to the eclipse. In getting the mean wind, I plotted the individual observations of direction and velocity, taking them as nearly as possible at regular intervals, and drew the resultant direction for each station. As a check on this method and for greater exactness I next computed the mean wind for stations where the wind directions were recorded to degrees of azimuth, or the observations were otherwise considered sufficiently accurate. Observations to only eight points of the compass are not in general sufficiently accurate to show the eclipse wind. The general winds were from the southwest near the central path of the eclipse of May 28, 1900, in our Southern States, and the observations with which I had to deal were something like the following:

	Direction in degrees.	Velocity in miles.
(1)	S. 23° W.	3
(2)	S. 56° W.	2
(3)	S. 80° W.	1

These were plotted as shown in diagram 1 *A*, in which the continuous arrows are the observed winds and the broken arrow is the mean wind. With the above values the plotted mean was found to be S. 44° W. Calling the observed wind o and its velocity v, the mean was then computed as follows:

	sin. o	cos. o	(sin. o)v	(cos. o)v
(1)	.391	.921	1.173	2.763
(2)	.829	.559	1.658	1.118
(3)	.985	.174	.985	.174
Sum.			3.816	4.055

$$\log. 3.816 = 0.582$$
$$\log. 4.055 = 0.608$$
$$\text{diff.} = \log. \tan. \theta = 9.974$$
$$\theta = 43°$$

θ is the mean wind, and in computing it in the present case it was not necessary to consider the sign of the quadrant, as all were in the same quadrant. It is seen that the plotted mean and the computed mean agree within one degree, and agreements approximating to this I found throughout the work. Diagram 1 *B*, gives an example of another set of winds. These examples are only to illustrate the methods. In the actual computations there were from 10 to 30 observations. In my statement of the formula, Professor Bigelow thinks the *v* should precede the sin. *o* and cos. *o*, but why he attaches importance to this I do not know. The product of *xy* is the same as that of *yx*. It is distinctly stated in my paper that *o* is the observed direction and *v* the observed velocity, so I fail to see how there could be any misunderstanding; but, if a change is needed, it would seem to me best to give the formula thus:

$$\tan. \theta = \frac{\Sigma\ (v \sin.\ o)}{\Sigma\ (v \cos.\ o)}.$$

Having found the mean wind, my next step was to find the direction and velocity of the wind which, acting on the mean wind, would produce the observed wind in each case. This I sought to do by means of the well-known parallelogram of forces, as shown in Fig. 2. In this diagram, if *AB* represents the mean wind and *AC* the wind observed at some given time, then *AC* may be assumed to be deflected from the mean by a wind having the velocity and direction of *AD*. By plotting the observations in this way, I obtained the resultant winds for different portions of the eclipse area, and having plotted them, found evidence of a systematic circulation around the center of the eclipse area. This circulation followed the eclipse, and hence I conclude that it is caused by the eclipse. As before, I endeavored to check the plotted results and obtain greater accuracy by computing the resultant wind *AD* for certain of the stations. To do this, without changing the position of *AD*, I drew a line as represented by the dotted line *BD*, and from

FIG. 1.

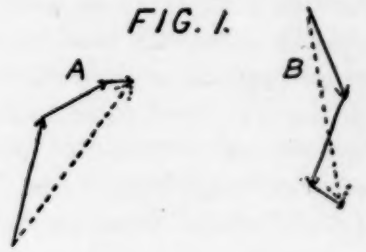


FIG. 2.

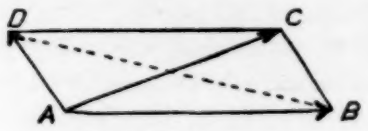


FIG. 3.

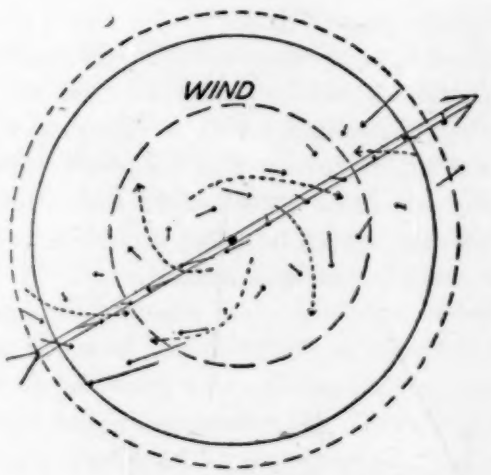
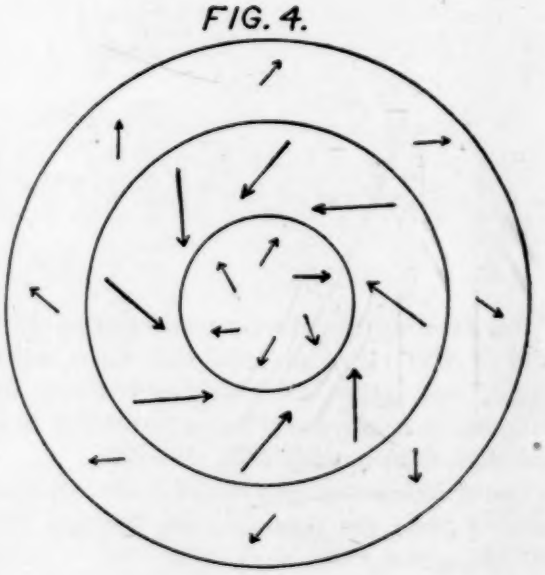


FIG. 4.



the triangle *ABD* proceeded to compute *AD* by well-known trigonometrical relations. I do not know why Professor Bigelow should find confusion because, in changing from plotting *AD* to computing *AD*, I changed the diagonal from *AC* to *BD*. I explained much of this in my paper, but, as I was writing for scientific men, it did not seem to me necessary to explain all the elementary processes.

Further details are given in the *Bulletin* of the Blue Hill Meteorological Observatory containing my discussion (*Annals* of the Astronomical Observatory of Harvard College, Vol. XLIII., Part 1, Observations and Investigations of the Blue Hill Meteorological Observatory, A. Lawrence Rotch, Director).

The final results as regards the wind circulation are illustrated in Fig. 3. In this diagram the arrows indicate, in the usual way, the direction of the resultant wind for different portions of the eclipse area, and the lengths of the arrows indicate the velocity of the wind. The central dark spot shows the area where the eclipse was total and the outer continuous circle shows the outer limit of the penumbra. The inner circle of broken lines shows the position of a probable ring of low pressure and the outer circle of broken lines shows the probable position of a ring of high pressure. The change of pressure found during the eclipse was in perfect accord with this latter conclusion derived from the wind circulation, and Professor Bigelow says that the observations of the Weather Bureau confirm my curve of pressure. The tendency to an anticyclonic circulation of the wind near the central area of the eclipse is confirmed by the observations of Professor Upton and Mr. Rotch in previous eclipses. (See *Amer. Meteor. Jour.*, Vol. IV., p. 456, Feb., 1888; also *Annals* of the Astronomical Observatory of Harvard College, Vol. XXIX., p. 18, 1893.)

I infer that Professor Bigelow does not seriously question the results as given by me, as he says Ferrel's 'cold-center cyclonic circulation * * * is just the opposite of the result of the eclipse observations.' It is the interpretation of the observations to which Professor Bigelow objects.

When I discover a new fact, it seems to me proper and even necessary for the advancement of science to consider the relation of the new fact to earlier known facts and to accepted theories and generalizations. In doing this I attempt to compare all the various facts and theories accessible to me and accept the best.

In considering the bearings of the eclipse data, I read among other things the views of Professor Bigelow in the International Cloud Report to which he refers. I find myself unable to accept his views of the air circulation in cyclones which he derives from the cloud observations, nor is his explanation of the diurnal change in pressure as an electromagnetic phenomenon satisfactory. However, in publishing results it is usually not possible for an author to enter into detail in regard to conclusions with which he is not in accord, nor is it best because it arouses strife and feeling. It seems best to give one's own conclusions and leave the future student to decide between conflicting views, as we have done.

In comparing my eclipse data with the different theories, I found that the results agreed so perfectly with certain views expressed by Ferrel concerning the cyclone with a cold center, that it leaves me no room for a new theory nor an improvement on his.

Ferrel says, "The conditions of a cyclone with a cold center which are the most nearly perfect are those furnished by each hemisphere of the globe, as divided by the equator, in which the pole is the cold center, and the temperature gradient from the pole toward the equator is somewhat symmetrical in all directions from the center. * * * The center of a cyclone with a cold center may, or may not, have a minimum pressure, according to circumstances. A certain amount of temperature gradient, and of pressure gradient which is independent of the gyratory motion, as explained in § 72 in the case of the general circulation of the atmosphere, is necessary to overcome the friction in the lower strata and to keep up the vertical circulation, upon which the cyclone depends; and the pressure gradient, which depends upon the temperature gradient and is independent of the gyrations, may be such that the increase of pressure in the central part due to this cause may be greater than the decrease of pressur

arising from the cyclonic gyrations, especially where surface friction is great" ('A Popular Treatise on the Winds,' pp. 338–339). This is from Ferrel's latest book, and note that he says the increased pressure 'is independent of the gyrations.' He explains that the velocity, v, of the air circulation tends to decrease the pressure at the center of the cyclone and not at the same time cause a rise of pressure, as is assumed by Professor Bigelow. The § 72 referred to reads as follows:

"The first effect of the motion in the upper strata of the atmosphere from the equator toward the pole, as in the case of the water flowing from the warmer toward the colder end of the canal, would be to fill up a little, as it were, the polar region with air from the equatorial, the effect of which is to increase the pressure a little in the former and to decrease it a little in the latter region, thus creating at the earth's surface and in the lower strata a gradient of pressure decreasing from the pole toward the equator, which would cause a counter current in the lower strata."

Ferrel does not state here whether the counter current would be anticyclonic or not, but states in other passages that such a gradient under the influence of the earth's rotation *would* produce an anticyclonic circulation. However, we are not left to inference in regard to Ferrel's views in this matter, for in the *American Journal of Science* (2 Ser., XXXI., p. 33, par. 15) he states his views explicitly as follows:

"Near the poles the tendency to flow toward the equator seems to be the greater, and causes a current there *from* the poles, which being deflected westward (5) causes a slight northeast wind in the north frigid zone, and a southeast wind in the south frigid zone. But this is only near the earth's surface, and the general tendency of the atmosphere in the upper regions must be toward the east as will be seen."

In the paper just quoted Ferrel gives a diagram of the air circulation in the polar cold-air cyclones which shows the circulation about the north pole as given in Fig. 4, in which I have made the north pole the center of the circulation for comparison with the eclipse circulation. The circulation around the pole indicated by Ferrel agrees with that shown by observations, as will be seen by comparing it with the carefully prepared charts in the 'Report on the Scientific Results of the Exploring Voyage of H. M. S. *Challenger*, 1873–76' (Vol. II.).

The similarity to the wind circulation found in the eclipse area must be apparent to every one (compare Figs. 3 and 4). The chief difference is that the anticyclonic circulation around the center, as compared with the surface inflow, is relatively larger in the eclipse circulation, and the outer circle of outblowing winds in the latter is only faintly indicated, owing to lack of observations. But the larger anticyclonic circulation around the center in the eclipse is exactly what theory would indicate for a circulation over a continental area where surface friction is great, and in a case where the gradient necessary to overcome the friction is feeble.

It may be asked why the diagram quoted here from Ferrel differs so radically from those given by Professor Bigelow. The explanation, I think, is simple. Ferrel, for the purpose of mathematical treatment, in the examples which Professor Bigelow quotes, was dealing with ideal cases in which there was little or no friction When his theory was applied to actual conditions on a globe possessing friction, his illustration of the cyclone with a cold center was like that I have given, with an increase of pressure and an anticyclonic circulation in the center at the earth's surface. The greater the friction the larger the central anticyclone must be to overcome the friction and maintain the circulation.

This view of Ferrel's theory is exactly that taken by Professor Davis, who is probably the ablest student of Ferrel in this country (*Quar. Jour. of the Roy. Meteor. Soc.*, April, 1899, p. 165).

The necessity of making every detail clear about the eclipse cyclone makes it necessary to omit consideration of the diurnal cyclones, but I think enough has been said to make clear the reasons for the contrasted views of myself and Professor Bigelow.

H. Helm Clayton.

Blue Hill Observatory,
April 16, 1901.

LELAND STANFORD JUNIOR UNIVERSITY:

To the Friends of Stanford University:

The undersigned, members of the University Council [professors and associate professors] of the Leland Stanford Junior University, in view of the numerous publications following upon the resignation of Professor Ross, which reflect on the University and its founder, and on our connection with it, deem it wise to issue the following statement.

In doing this we do not impeach the good faith of those who have interested themselves in this matter because of the question of university policy involved, but we wish to affirm our confidence in the University, its founder and its president.

We have examined all records, letters and copies of letters in the possession of the University bearing upon this case, and are agreed:

1. That in the dismissal of Professor Ross, no question of academic freedom was involved.

2. That in the dismissal of Professor Ross, President Jordan was justified.

J. C. BRANNER, *Professor of Geology.*

O. P. JENKINS, *Professor of Physiology and Histology.*

MELVILLE B. ANDERSON, *Professor of English Literature.*

J. M. STILLMAN, *Professor of Chemistry.*

FERNANDO SANFORD, *Professor of Physics.*

CHAS. D. MARX, *Professor of Civil Engineering.*

CHARLES H. GILBERT, *Professor of Zoology.*

DOUGLAS HOUGHTON CAMPBELL, *Professor of Botany.*

EWALD FLÜGEL, *Professor of English Philology.*

CHAS. B. WING, *Professor of Structural Engineering.*

FRANK ANGELL, *Professor of Psychology.*

W. R. DUDLEY, *Professor of Botany.*

A. T. MURRAY, *Professor of Greek.*

JULIUS GOEBEL, *Professor of Germanic Literature and Philology.*

NATHAN ABBOTT, *Professor of Law.*

JOHN E. MATZKE, *Professor of Romanic Languages.*

GEORGE M. RICHARDSON, *Professor of Organic Chemistry.*

JAMES O. GRIFFIN, *Professor of German.*

WALTER MILLER, *Professor of Classical Philology.*

RUFUS L. GREEN, *Professor of Mathematics.*

O. L. ELLIOTT, *Registrar.*

VERNON L. KELLOGG, *Professor of Entomology.*

LIONEL R. LENOX, *Professor of Analytical Chemistry.*

A. G. NEWCOMER, *Associate Professor of English.*

ARTHUR B. CLARK, *Associate Professor of Drawing and Painting.*

F. M. MCFARLAND, *Associate Professor of Histology.*

CLEM. A. COPELAND, *Associate Professor of Electrical Engineering.*

G. C. PRICE, *Associate Professor of Zoology.*

J. C. L. FISH, *Associate Professor of Civil Engineering.*

H. C. NASH, *Librarian.*

ELLWOOD P. CUBBERLEY, *Associate Professor of Education.*

GUIDO H. MARX, *Associate Professor of Mechanical Engineering.*

GEORGE A. CLARK, *Secretary to the University.*

JAMES P. HALL, *Associate Professor of Law.*

OLIVER M. JOHNSTON, *Associate Professor of Romanic Languages.*

GEORGE J. PEIRCE, *Associate Professor of Botany.*

HERMAN D. STEARNS, *Associate Professor of Physics.*

STANFORD UNIVERSITY, CAL.,
March 18, 1901.

CURRENT NOTES ON PHYSIOGRAPHY.

TOPOGRAPHIC ATLAS OF THE UNITED STATES.

THE second folio of this atlas, prepared like the first by Gannett, includes some striking topographic types. The Dismal swamp (Norfolk sheet, Va.) is given as an example of a coast swamp; discharge of its waters is prevented by the abundant vegetation on the flat uplands of a low coastal plain whose surface has been somewhat dissected and whose shore line has been extended inland by a slight submergence which has drowned many valleys. A number of the branching bays are headed by valley swamps of a different type from those of the plain. The lower Missouri is given as an

example of graded river (Marshall sheet, Mo.); that is, "its course has been eroded to almost as low a stage as possible, and its slope has become very slight, so that its cutting power is trifling." Reference to the balanced relation of load and carrying power might have here been made to advantage. There is perhaps some objection to citing the Missouri as an example of a normally graded river, as it is probable that the present Missouri has established its flood plain by aggrading rather than by degrading the valley floor. The Platte river (Lexington sheet, Neb.) is instanced as an 'overloaded' stream, of which class it is certainly a very striking example; but it is to be regretted that, as the term 'graded' was adopted for the Missouri, 'aggraded' or 'aggrading' was not employed for the Platte.

The linear Appalachian ridges are beautifully shown where the Susquehanna cuts across them (Harrisburg sheet, Pa.), types of their class for the world. The text of this example is somewhat less satisfactory than that of the others: tributaries are said to cut down their beds more rapidly than the main river; the sinuosities of the side streams are ascribed to the retarded erosion of the Susquehanna across the hard rocks, instead of to the pause in uplift, during which the inter-ridge lowlands were etched out; indeed, no explicit mention is made of these lowlands as local weak-rock peneplains, although the extraordinary enclosed meanders of Conedoguinet creek are referred to a time when the Susquehanna was 'held at one level for a considerable period'; 'subsequently, by some means, the river succeeded in lowering its bed' and its tributary followed suit. 'By some means' might be well replaced by 'after an uplift.' The diagram giving a section of some of the ridges does not properly represent the dip of their strata, and the Medina formation is labelled Potsdam. Finer examples than the alluvial fans ('cones') of southern California and the huge basin of Crater lake in Oregon could not be selected for the closing numbers of this folio, which contains ten sheets in all.

TERRACES FRONTING THE ROCKY MOUNTAINS.

At various points piedmont to the Front range of the Rocky mountains in Colorado, there are sloping gravel-covered plains or mesas, into which the streams have cut their valleys. Lee describes some of these (The origin of débris-covered mesas of Boulder, Colorado. *Journ. Geol.*, VIII, 1900, 504–511, 4 figs.) and emphasizes the contemporary date of the graded piedmont surface, beveled across the underlying rocks, and the deposits of coarse waste with which it is covered; both are the product of the lateral shifting of streams, cutting on one side and filling on the other; the waste, 25 to 50 feet in thickness, being chiefly a flood deposit. The present action of the stream at Boulder in its channel and on its flood plain imitates the former action by which the intermediate mesa terrace and the higher mesa were produced. It is suggested that the three grade plains thus indicated "do not seem necessarily to require the assumption of any change in the attitude of the land subsequent to the elevation of the mountains, but are the natural sequences of erosion as influenced by the local distribution and difference in hardness of the formations involved." A gradual down-cutting with an active lateral shifting appears to account for the features described.

THE FORMATION OF DESERTS.

'Das Gesetz der Wüstenbildung in Gegenwart und Vorzeit' (Berlin, 1900, 175 p., 50 views) is a new work by Walther, already known for his studies of desert denudation. The book opens with a comparison of sea floors and desert surfaces; each one becomes smoother by filling with waste from the enclosing highlands, the coarser waste remaining near the margins; but the deposits in one contain few records of life, while those of the other may teem with fossils. Special accounts are given of the process and results of dry weathering, of wind erosion (deflation) and of water action in arid regions. The forms assumed under these processes are well described and illustrated. Rock ledges are left bare, frequently with a pitted surface; they are sometimes found worn down to a small relief and strewn with a scanty covering of waste. The popular impression that deserts are plains is held to be not so far from the truth as is sometimes taught, since so large a part of arid landscapes is degraded

or aggraded to a nearly even surface. The crescentic sand-dune is taken as a normal form on an open surface. The necessity of a former pluvial period to explain the wadies of deserts, as stated by some writers, is doubted; and in spite of the violence of occasional cloud-burst floods, the chief agency in the preparation of desert topography is held to be the wind; a conclusion that seems to have been long familiar to the Bedouin, just as the transportation of erratics by a former extension of glaciers has long been known to Swiss peasants. The importance of identifying ancient desert formations in the geological series is emphasized.

Although peneplanation under arid conditions is not excluded from the Walther discussion, the systematic advance of the processes of arid denudation through an ideal cycle and the description of the forms thus successively developed are not fully presented. Old and young deserts are not clearly separated. In some arid regions, the marginal deposits of the coarse waste rise upon the flanks of the enclosing mountains; in others a piedmont slope of evenly degraded rock, veneered with thin sheets of waste, slopes gently forward from the mountain base. The first is probably a younger form than the second; but no one has yet studied out the full series of still younger and still older forms of an arid landscape.

W. M. DAVIS.

THE AMERICAN GEOGRAPHICAL SOCIETY.

THE American Geographical Society will move into its new building in 81st Street, New York, in the course of the next two or three months. The Society has at present about 1,200 members and, to still further increase its numbers, has sent out a circular, from which we quote the following:

The objects of the American Geographical Society are: The collection, discussion and diffusion of geographical information; the promotion of the exploration of our territory and of the survey and preservation of our harbors; the establishment in the chief maritime city of the Union of a place where will be afforded the means of obtaining accurate information of every part of the globe, and the registration and careful record of discoveries and studies in geography and the related sciences.

The Society was founded in 1852. One of but twelve similar societies at that time, it now exchanges its publications with three hundred scientific associations scattered throughout the world.

The Society has outgrown the house, No. 11 West Twenty-ninth Street, in which it has been lodged for more than twenty years. A handsome fireproof building is now being erected in West Eighty-first Street, opposite Manhattan Square. This will afford perfect security to the library of 30,000 volumes—one of the foremost geographical libraries of the world—the thousands of maps and charts and the collection of atlases of the sixteenth, seventeenth and eighteenth centuries, now in the map rooms, and will also provide ample accommodation for readers and students.

Travelers, men of science, and others properly accredited, are welcomed at the rooms of the Society and freely offered the use of the library and collections.

The Society is now free from debt and possesses a property which has of late been steadily growing in value.

It is desired to add to the number of fellows on the roll in order to strengthen and extend the influence and the usefulness of the Society.

No special qualification for fellowship is required other than interest in the spread of knowledge and the advancement of science. The annual dues are $10.

RESOLUTION OF THE COMMITTEE OF CENTRAL NATURALISTS.

AT a meeting of the committee appointed by the Chicago meeting of naturalists to arrange for the next meeting, held at Chicago, March 28th, the following was voted. The vote has since been submitted to a number of the older members of the American Society of Naturalists living in the Central States and has been approved by them. It may, therefore, be taken to represent the prevailing sense of the naturalists of the Central States.

VOTED: Whereas, the naturalists of the Central States propose to meet annually at some convenient point for intercourse and the reading of papers;

And whereas, no point east of the Alleghenies (to which territory the meetings of the American Society of Naturalists are by its constitution confined) is practicable as such meeting point;

And whereas, the central naturalists would view with approval the formation of a national body which might properly be called the Amer-

ican Society of Naturalists, by which name the eastern society is now known ;

And whereas, it is desirable that the organization of the central naturalists should be coordinate with the eastern society ;

And whereas, it is desirable that all the naturalists of the country should, as far as possible, come together from time to time in a national general gathering ;

Resolved, that the naturalists of the Central States form a permanent organization and that they favor a coordinate relation of this association and that of the Eastern States, as eastern and central branches respectively of the American Society of Naturalists.

That the two organizations meet annually in their respective territories (except as stated below), have the same conditions of membership, elect their own officers and collect and disburse their own funds ;

That the records of the two branches, including lists of members, be published jointly at joint expense and under the joint editorship of the secretaries of the two branches ;

That every third year the two branches meet together alternately in the East and in the Central States, that the officers of the meeting be those of the receiving branch, and that visiting members enjoy full privileges, except as may be agreed upon at the time of joint ratification of this resolution ;

That this resolution be transmitted to the American Society of Naturalists at its Chicago meeting, with the suggestion that it be referred to a committee to arrange further details and that the report of the committee be received and acted upon at the same meeting ;

That, a copy of these resolutions be printed in SCIENCE to give an opportunity for full discussion of them.

C. B. DAVENPORT,
Secretary of Committee.

SCIENTIFIC POSITIONS UNDER THE GOVERNMENT.

A NUMBER of important scientific positions will be filled by civil service examination on June 3d. It is desired to establish an eligible register for the positions of plant physiologist and plant pathologist in the office of Plant Industry, United States Department of Agriculture, with salaries of $1,800 per annum. The competitors will not be assembled for this examination, but must make application for the special form and send the following information not later than the date mentioned. The statements in physiology, those in pathology being similar, together with the weights, are as follows :

1. A statement of the line of study pursued in the colleges in which the competitor has received degrees or in which he has carried on work :
   (*a*) Technical and practical work with plant physiology. 20
   (*b*) Scientific research in physiology and coordinate lines 20
   (*c*) Submission of a list of articles on physiology and related subjects published by competitor 25
2. A statement of the competitor's experience as an executive officer or teacher..... 15
3. A statement of not less that 500 words setting forth the present status and prospective development of plant physiological research..... 20

An examination will be held on the same day in any city where postal free delivery has been established for the position of assistant in the seed laboratory of the Division of Botany with a salary of $1,200, the subjects and weights being as follows :

1. Essay on methods of conducting purity tests (orthography and penmanship will be marked on this exercise) 10
2. Structural botany..... 15
3. Morphology of the seed 20
4. Reading botanical German 10
5. Drawing of seeds 15
6. Identification of seeds..... 30

An examination under similar conditions will be held for the position of a field assistant in the Department of Agriculture, with a salary of $1,000. Here the subjects and weights are :

1. Forestry..... ...(sheet 1)..... 60
2. Botany..... .....(sheet 2)..... 10
3. English composition.....(sheet 3)..... 10
4. Education and experience.....(sheet 4)..... 20

An examination for the position of computer in the Division of Forestry, with a salary of $1,000, will also be held, the subjects being :

1. Forest mensuration..... 60
2. General forestry..... 25

3. Education and experience..... 15

For the position of ethnologist in the Bureau of American Ethnology, at a salary of $1,500, an examination will be held as follows:

1. Essay on ethnologic and archeologic subject..... 20
2. Experience in ethnologic work (*a*) in the field; (*b*) in writing, teaching, etc..... 20
3. Original publications on ethnologic and archeologic subjects..... 20
4. The geographic, ethnologic, and archeologic features of Arizona and New Mexico..... 30
5. Literature of ethnology and archeology of southwestern United States..... 10

SCIENTIFIC NOTES AND NEWS.

A MEETING was held at Cambridge University on April 27th to arrange for some acknowledgment of the services to science and the University of Professor G. D. Liveing. Professor Liveing is now seventy-three years of age. In 1852 he organized the chemical laboratory at Cambridge which was the first scientific laboratory in the University.

DR. EDMUND B. WILSON, professor of zoology at Columbia University, and Dr. J. Playfair McMurrich, professor of anatomy at the University of Michigan, are among the Americans who will attend the International Zoological Congress to be held in Berlin from the 12th to 19th of August.

THE U. S. Biological Survey has been engaged for several years in studying the geographic distribution of animals and plants in Texas, with a view to the preparation of maps showing the limitations of the life zones and faunal areas in that State. Mr. Vernon Bailey, chief field naturalist of the Biological Survey, has charge of this work and has recently gone to southwestern Texas to begin field operations for the season of 1901. He is assisted by Mr. H. C. Oberholzer.

DR. D. A. CARMICHAEL, recently appointed federal quarantine officer in San Francisco, has arrived in that city. He has presumably been given this appointment on account of his success in suppressing the plague in Honolulu.

DR. GEORGE BLUMER, of the Bender Laboratory at Albany, has been appointed director of the Bureau of Bacteriology and Pathology, newly established by New York State.

PROFESSOR H. POTONIÉ and Dr. Aug. Denckmann have been appointed geologists in the Geological Bureau at Berlin.

MR. EVELYN BALDWIN, who is shortly to lead the North Polar expedition equipped by Mr. Ziegler, has gone to Norway and Denmark in connection with his preparations. He will shortly go to Dundee to join the steamer *America* which he recently acquired for the expedition.

MR. W. H. C. PYNCHON has given a course of six lectures at Trinity College upon the 'Geology of the Connecticut Valley Lowland.'

MISS C. M. DERICK, lecturer in botany at McGill University, has been granted a year's leave of absence, and will study botany under Strasburger at Bonn.

DR. THOMAS CONRAD PORTER, since 1866 professor at Lafayette College, died on April 27th, at the age of seventy-nine years. Dr. Porter at first taught the natural sciences at Lafayette College, while later his work was confined more especially to botany. He was made emeritus professor four years ago, but remained dean of the Pardee Scientific School. He was the author of a 'Botany of Pennsylvania,' 'A Synopsis of the Flora of Colorado' and other works. He was a man of great learning, belonging to the older school of naturalists, and, although he left very valuable collections and notes, it is to be feared that a vast fund of valuable information is lost by his death.

THE death is announced, at the age of 82 years, of Mr. James Douglas Reid, who was interested in the construction of the early telegraph lines in this country. He was the author of a book entitled 'The Telegraph in America,' and for a while conducted a journal devoted to telegraphy.

WE regret also to record the death at the age of 82 years, of F. K. M. Feofilaktow, lately professor of geology in the University at Kiew, of Dr. Adolph Hirsch, professor of astronomy in the University of Neuchatel and director of the observatory, and of Dr. S. Lamanski, the physicist of St. Petersburg.

THE International Association of Academies

will hold its next meeting in London in 1904. It does not seem possible to obtain information in regard to the recent meeting until the *Comptes rendus* are published.

THE Thirty-ninth Congress of the Sociétés Savantes met at Nancy last month with about two hundred and fifty delegates in attendance.

A CONFERENCE of State University presidents will be held at the University of Illinois on May 1st and 2d. The following presidents are expected to attend the meeting: James H. Baker, of the University of Colorado; Joseph Swain, of the University of Indiana; George E. McLean, of the University of Iowa; Acting Chancellor W. C. Spangler, of the University of Kansas; James B. Angell, of the University of Michigan; Cyrus Northrop, of the University of Minnesota; R. H. Jesse, of the University of Missouri; Chancellor E. B. Andrews, of the University of Nebraska; W. C. Thompson, of the University of Ohio; W. E. Stone, of Purdue University, and Acting President E. S. Birge, of the University of Wisconsin.

A METRIC Association is being organized in Canada, the object of which is to prepare the people for the adoption of the metric system.

THE French Association of Anatomists held its third meeting at Lyons in April under the presidency of M. Renaut. There were about fifty students of anatomy in attendance, including a number of foreigners. The next meeting of the Association will be held at Montpellier in 1902 under the presidency of M. Sabatier.

THE committee of the British National Physical Laboratory announces that it is prepared to receive applications for appointments as members of the staff of this laboratory, the buildings of which will be in the grounds of Bushey-house, Teddington. It will appoint a superintendent of the engineering department, with a salary of £400 per annum; one or two assistants in the physics department, with salaries of from £200 to £250 per annum; and one assistant in the physics department to take charge of such chemical investigations as may be required, with a salary of £200 per annum. The committee is also prepared to receive applications for a small number of junior assistantships, at salaries of from £100 to £150 per annum. Applications, accompanied by a limited number of testimonials, should be made, not later than May 24th, to the director, National Physical Laboratory, Old Deer Park, Richmond, Surrey.

PREPARATIONS are being made by the Division of Forestry of the Department of Agriculture to remove from its present crowded quarters to offices on the sixth, seventh and eighth floors of the Atlantic building. Under the reorganization plan of the Department of Agriculture, authorized by the last Congress, the Forestry Division will, on July 1st, become a bureau of the Department.

THE American Museum of Natural History, New York, has acquired a valuable collection of Peruvian antiquities, including Indian pottery, musical instruments, stone implements, gold and silver vessels, and the like.

THE New York Academy of Medicine has been given a fund of $10,000 by Mrs. S. B. Gibbs and Miss G. B. Gibbs for the establishment of the Edward N. Gibbs memorial prize fund.

M. SANTOS-DUMONT, to whom the prize of the Paris Aeronautical Club was awarded in 1900, has returned the money to the Club to be used as the foundation for a new prize. The amount is 100,000 fr., and the income is to be given to the members of the Club who can make a circuit of the Eiffel Tower and return to the point of departure at St. Cloud.

A TELEGRAM has been received at the Harvard College Observatory, dated May 2d, from its station at Arequipa, stating that a very bright comet was seen at eleven hours thirty-five minutes (Greenwich mean time) in R. A. $3^h\ 30^m$ and Dec.—1°. This is presumably the comet announced by Dr. Gill, April 24, 1901. It seems to be no longer visible in the northern hemisphere.

THE *Electrical World* states that the Administration of Posts and Telegraphs contemplates the introduction of wireless telegraphy in Spain on a large scale. It is rumored that Marconi will soon go to Madrid to arrange matters with the Government. The Balearic and Canary Islands are first to be connected by this system, which will then be extended from these islands

to the Continent. Several places on the coast of Morocco, such as Ceuta, etc., will be connected with Algeciras and Tarifa.

MR. H. E. BIERLY, professor of biology in the State College at Tallahassee, Fla., succeeded during the last meeting of the State Teachers' Association in having child-study made a special department of the Association, and was elected director. During the last month the women's clubs, mothers' clubs and kindergarten associations in the State have been taking up the subject under his direction. The State superintendent of public instruction recommends the work officially. All the colleges, normal schools, etc., in the State are giving their hearty support to the movement and are very much interested in the subject.

THE Paris correspondent of the New York *Evening Post* writes as follows regarding an address made by Professor Bernheim, at the congress of French learned societies held recently at Nancy:

> The venerable Professor Bernheim, the founder of the famous school of Nancy, which still holds out against Charcot and the Salpêtrière, made an impassioned declaration of his beliefs and principles. He utterly denies the hypnotic character of the phenomena observed in the patients of the Salpêtrière, whom he declares to be mere hysterical personages. He developed at length his theory of the universal suggestibility of all men; he denied once more the existence of anything like a magnetic fluid, under whatever name. There is a radical defect in experiments concerning thought transferrence, which he says ought rather to be spoken of as treason than as a veritable transferrence of brain influence. There was some bravery in this renewed declaration of opinion on the part of one who has already suffered excommunication from the most recent science.

Just what is meant by the last sentence is not clear, but it is apparently intended to indicate that Professor Bernheim's science is antiquated because he does not believe in the vagaries of the Salpêtrière or in telepathy. It is difficult to understand why a journal as carefully edited as the New York *Evening Post* should not submit its scientific news to an expert for revision.

THE London *Times* states that an apparatus, invented by Mr. Poulsen, of Copenhagen, for recording telephonic messages is now being shown in London. The invention, which can be used in substitution for, or in cooperation with, any ordinary telephone receiver, consists essentially of a long steel wire or ribbon, which passes rather rapidly before the poles of a small electromagnet. This electromagnet, which is wound with very many turns of exceedingly fine wire, is inserted in the telephone circuit by the current in which it is magnetized. The steel wire is of course also magnetized, and the essence of the machine lies in the fact the magnetization induced in the successive portions of the wire varies in agreement with the undulations of the electric current in the telephone circuit, produced by the voice of the speaker. To read the message it is only necessary to pass the steel wire in the same direction past the poles of the same or a similar electromagnet, when the same undulations will be set up in the current passing through its coils and consequently the same sounds reproduced in the attached receiver. In the instruments in London these reproduced sounds are remarkably true and pure. It is said that the same message may be reproduced from what may be called the sensitized ribbon an indefinite number of times, but, if it is desired to remove the record, that can be simply effected by subjecting the wire to a constant magnetizing force, such as is obtained by passing an unvarying current through the electromagnet. In one form of the machine ordinary pianoforte wire is employed, and is wound helically round a brass cylinder rotated by a electric motor. In another, which is adapted for longer messages, thin steel ribbon is wound on and unwound from two rolls alternately. The curious thing here is that, although no magnetic screen or insulator is interposed between the successive layers of ribbon, the magnetization produced in every portion of them is preserved unaltered. In a third form, a continuous steel band is stretched between two revolving pulleys; at one point is placed the electromagnet connected with the transmitting telephone, and beside it is any number, limited only by considerations of space, of electromagnets connected with receiving telephones, each of which in turn receives the message impressed on the ribbon. After the ribbon has passed all these electromagnets it is sub-

jected to the influence of several permanent magnets by which it is, so to speak, wiped clean and prepared to receive another series of magnetic impressions.

M. Darboux, in welcoming the delegates to the International Association of Academies at the recent Paris meeting, according to the report in the London *Times*, attributed the original idea of association for scientific research to Lord Bacon, recalling the curious conception of the College of the Six Days' Work or the House of Solomon, which, however, was never realized. To-day, such was the range of scientific activity, no such scheme could ever be realized, and only the common agreement and reciprocal support of the nations could suffice even to undertake the solutions of the problems which were now imposed in all their multiplicity on the attention of the world. Such agreement had been secured for a certain number of special questions, such as the International Bureau of Weights and Measures, the International Geodetic Association, the Association for the Map of the Heavens and, notably, the international catalogue of scientific literature, due entirely to the initiative of the Royal Society. M. Darboux then continued: This international cooperation, which has always proved its value in all the cases where it has been found indispensable, will be assured in a lasting, normal and universal way by the formation of our Society. The task that we have undertaken may appear difficult, but it has become absolutely necessary, and the spirit actuating us ought to give us the assurance that we shall succeed by our united efforts in overcoming all difficulties. In constituting under a visible and permanent form this universal academy, which had been conceived and prepared by Leibnitz, many of whose other dreams, moreover, have been realized or are being realized, our Association will render to civilization and science a service of which it is impossible to exaggerate the importance. Thanks to it, the man of science devoting his life to the most delicate or the most abstract researches will cease to feel himself isolated, while still preserving that independence which is the greatest good and the primary need for the investigator. By uniting in the different academies all those who are studying the same subjects, by giving them, if they wish it, the opportunity of joining in a common work, by drawing the attention of the governments to all the schemes the speedy realization of which is necessary or desirable, by indicating to them also the means of executing these schemes in the most favorable conditions and with the greatest possible saving, and by proposing and preparing through the common understanding of *savants* in the domain of theory the agreements of peoples on the basis of practice and facts, our Association is destined to become rapidly one of the most powerful instruments of concord and of progress. It is with this firm conviction that I declare open the first general assembly of the International Association of Learned Societies.

At a meeting of the Geological Society of London, on March 6th, Professor George Frederick Wright, of Oberlin College, presented a communication entitled, 'Recent Geological Changes in Northern and Central Asia,' the paper being the outcome of a journey made by the author in company with Mr. Frederick B. Wright in 1900–1901. He said that in North America an area of about 4,000,000 square miles was brought under the direct influence of glacial ice during the Glacial Epoch. The result of six weeks spent in Japan was to show that there are no signs of general glaciation in Nippon or Yesso. Neither is there any sign of glaciation along the border of the Mongolian Plateau, where the general elevation is 5,000 feet, but the whole region is covered with lœss. This has usually accumulated like immense snow-drifts on the southeastern or lee side of the mountains, and in it houses and villages are excavated. In the mountainous region, strata of gravel and pebbles are so frequent in the lœss, that it is necessary to invoke both wind and water in order to explain fully the origin of the deposit. At the present time the lœss in the interior is being washed away by streams much faster than it is being deposited by the wind. The journey across Manchuria from Port Arthur along the Lao-Ho and Sungari rivers was through valleys choked with alluvium, and there was no evidence that the drainage of the Amur had ever been reversed by ice, like that

of the St. Lawrence; nor was there any other evidence of glaciation. The lower course of the Amur indicates subsidence. Again, there are no signs of glaciation on the Vitim Plateau. Lake Baikal appears to be of recent origin; it is 4,500 feet deep and has not been filled by the great quantities of sediment brought down by the Selenga and other rivers. Although glaciers could frequently be seen on the mountains which border the Central Asiatic Plateau to the northwest, there was no evidence that the glaciers had ever deployed on the plain. The lœss-region of Turkestan, and indeed the whole area from the Sea of Aral to the Black Sea, appears to have been recently elevated, in some places as much as 3,000 feet. Desiccation took place at the same time, so that the larger lakes are only brackish or still fresh. Direct evidence of this in the form of deposits is given. The author thinks it likely that the absence of glaciation in northern Asia may have been due to the rainlessness of the region and that, while America was elevated, Asia was depressed during the Glacial Epoch.

THE Brussels Academy of Sciences announces, as we learn from *Nature*, the following prize subjects for 1901: New researches upon the compounds formed by the halogens between themselves (800 francs); the determination of the form of the principal terms introduced into the formulæ of nutation in obliquity and longitude by the elasticity of the earth's crust (800 francs); historical and critical discussion of Weber's experiments on unipolar induction, and new experiments bearing upon the laws and interpretation of this physical fact (300 francs); a contribution to the study of mixed forms with a number of series of variables, and the application of the results to the geometry of space (600 francs); history of researches on the variation of latitude, and a discussion of the interpretations of this phenomenon (600 francs); investigations of the physiological rôle of albuminoid substances in the nutrition of animals or plants (800 francs); new researches on the organization and development of *Phoronis*, and the relations existing between the animals *Rhadopleura* and *Cephalodiscus*, and the class to which the name Enteropneusta has been applied (1,000 francs); description of simple substances, sulphates and binary compounds of Belgian soil (800 francs); researches on the influence of external factors on karyokinesis and cellular divisions in plants (800 francs).

WE learn from the *Lancet* that on April 10th the committee of the Marine Biological Station at Millport received representatives from various educational bodies at the Station, with a view to extend a knowledge of the educational resources at their command. Dr. J. F. Gemmill, the president, gave a sketch of the new teaching arrangements, which include a course of lectures on marine zoology and botany, with practical demonstrations on Saturdays from April 27th to June 15th, inclusive, the introductory lecture to be delivered by Sir John Murray, K.C.B., F.R.S. The visitors were afterwards conducted over the laboratories, tank-room and museum by Dr. James Rankin, and then proceeded on a dredging excursion on the steam-launch *Mermaid*, recently presented to the institution. It is hoped that the new teaching arrangements will encourage the practical study of natural history among board school and other teachers, upwards of 40 of whom have already entered their names for the new classes. The science students in the University of Glasgow also find the station an admirable center for practical work, and the younger dons in the science faculty are energetically assisting in its development.

IT is announced that, through an expedition to Kenai Peninsula by Mr. Andrew J. Stone in the interests of the American Museum of Natural History, the Museum has received some fine specimens of the big Alaskan moose, recently described as *Alces gigas*. This animal is the largest known representative of the deer tribe, and differs from the moose of eastern Canada and Maine in its larger size and darker colors, but especially in the great development of its antlers, which are much larger than those of the eastern moose. Mr. Stone also obtained specimens of two species of bear and the head of a fine caribou. Other recent accessions of note are a collection of mammals from Peru, consisting of about one

hundred and fifty specimens, and representing some twenty-five species, of which quite a number proved new to science and others had been only recently described from specimens received at the British Museum. With this collection was also received a small collection of birds, which contained many species new to the Museum collection and several new to science.

UNIVERSITY AND EDUCATIONAL NEWS.

Mr. George W. Carroll, of Beaumont, Texas, has given $60,000 to Baylor University, at Waco, Texas, for a science building.

By the will of Miss Mary Shannon, of Newton, Mass., $125,000 is distributed among charitable and public institutions. Wellesley College receives $15,000 and several institutions for the education of negroes receive sums ranging from $5,000 to $10,000.

A building to contain the bacteriological and pathological laboratories is to be erected at the University of Michigan at a cost of $100,000.

As we have already announced the degree of Bachelor of Arts will hereafter be given at the University of Michigan without any requirement in the classical languages either at entrance or afterwards. It has now been decided that there will be no required subjects in the course, except English in the freshman year. In addition first-year students may select three subjects from the following: Greek, Latin, French, German, history, mathematics, physics, chemistry, biology.

It is expected that Cornell University will this June grant 380 baccalaureate degrees and 74 advanced degrees. They are apportioned as follows: 125 A.B. degrees; 1 B.S.; 44 LL.B.; 16 B.S.A.; 9 D.V.M.; 5 B.S.F.; 6 B.Arch.; 51 C.E.; 123 M.E. (including electrical, marine and railway M.E.); and 21 A.M. degrees; 9 M.S. in Agr.; 4 M.C.E.; 10 M.M.E.; 1 D.Sc.; 29 Ph.D.

The forty-five graduate students of the New York University, with one exception, have signed the following resolution, and forwarded it to the chancellor of the University and to the president of the University Council:

Resolved, that we, the undersigned members of the Graduate School of the New York University, sincerely regret the resignation of Professor Edward F. Buchner, Ph.D., Samuel Weir, Ph.D., and Professor Charles H. Judd, Ph.D., whose departure threatens the high standard and continuity of our courses, as well as the usefulness of the Graduate School, and respectfully request the authorities of the University to secure the continued services of those professors. Some of us also hold our Bachelor's and Master's degrees from this and other universities, and we believe that we are competent judges of professional worth, and hereby desire to express our unqualified repudiation of the aspersions cast upon the professional efficiency of Dr. Edward F. Buchner. Many of us have been in his classes, and we have uniformly found Dr. Buchner to possess a rich and rare gift of insight, a profound grasp of philosophical problems, as well as felicitous power of expression and painstaking and sympathetic class-room methods. Believing that this rare gift as a teacher and a scholar makes him an ornament to his profession and a credit to the University, we trust that the University Council will give this resolution full weight in their deliberations.

Professor E. A. Ross, of the University of Nebraska, recently of Leland Stanford Junior University, has been appointed a visiting lecturer at Harvard University for next year.

Owing to the recent complications, Dr. Arthur O. Lovejoy, associate professor of philosophy at Stanford University, has resigned.

Dr. Max Farrand, professor of history at Wesleyan University, has accepted the chair of history in Stanford University.

Dr. Edmund Arthur Engler, professor of mathematics at Washington University, St. Louis, and dean of the College of Engineering, has been elected president of the Worcester Polytechnic Institute.

Mr. J. W. H. Pollard, Dartmouth '95, has been appointed physical director in Lehigh University.

Dr. J. Stafford, lately of the University of Toronto, has been appointed lecturer in zoology at McGill University.

Dr. J. A. Gmeiner has been appointed associate professor of mathematics at the German University of Prague.